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Eighth Annual Meeting of the American Gas Light Association.

[SPECIAL FROM CHICAGO TO "AMERICAN GAS LIGHT JOURNAL."]

The Eighth Annual Meeting of the American Gas Light Association was held in Chicago, Ill., on the 13th, 14th and 15th days of October. The chair was occupied by the President, Wm. H. Price, Esq., of Cleveland, O. The meeting was one of the largest and most complete that was ever held by the Association. One hundred and twenty-five members were present. The following named gentlemen were unanimously elected as officers of the Association for the ensuing year: President, Wm. H. Price; Vice-Presidents, A. Hickenlooper, Theobald Forstall, Wm. A. Stedman; Secretary, Wm. Henry White; Finance Committee, John S. Chambers, A. B. Slater, Geo. S. Hookey; Executive Committee, Henry Cartwright, F. C. Sherman, A. C. Wood, Peter T. Burtis, T. Littlehales, Samuel Prichitt.

The President's address was very able and thoroughly practical, and well suited to the times. The following papers were read: On "Stopped Stand Pipes," by Theo. Forstall, of New Orleans, La.; "Mechanical Stoking," by A. Hickenlooper, of Cincinnati, O.; "Furnaces," by —— Weber, of ——; "Burners," by E. G. Love, of New York; "Gas Engines," by George. G. Ramsdell, of Vincennes, Ind.; "Illuminating Power for Compensation," by H. H. Edgerton; "Coal Tar," by —— Page, of New York; "Heating by Gas," by W. W. Goodwin, of Philadelphia, Pa.; "Water Gas," by W. H. Pearson, of Toronto, Canada. The usual complete stenographic report of the proceedings will be commenced in the next number of the JOURNAL.

THE ELECTRIC LIGHT.

We give below some translations from different French journals which relate to the applications of the electric light to grand illuminations on occasions where magnificent display is sought for. The 14th of July last was celebrated in Paris with all the gorgeous accessories which the French people know so well how to use; and, among other things, the electric light was brought forth to assist, and, from all the accounts, it demonstrated its usefulness in adding splendor and a dazzling brilliancy to the occasion.

Of course, at times like these, effects are sought to be produced without special regard to the cost, and it is to be expected that in the accounts given no particular mention is made of the cost of establishing the machinery, steam boilers, and other apparatus employed—

"On the night of the 13th (July) the Tribunal of Commerce, where the Municipal Council of Paris received the deputations from the different municipalities of France, demonstrated the power of the electric light. The monument was covered with an immense canopy, under which eight Jablochkoff candles were lighted. The reflection thus produced was of a fairy-like character which appeared to trouble the advocates of gas.

"The lighting of the exterior of Notre Dame was effected by 44 lights, placed upon salient points.

"Thirty-six lights were placed upon the Façade, arranged with reflectors in front of them, which were pierced with an opening allowing the light to be seen directly. There was thus a constellation of 44 stars, rendered more brilliant by the penumbra which surrounded them, and which detached them from the reflected light upon the façade with extraordinary brilliancy. * * * *

"In the Garden of the Luxembourg there were 16 lights, of which four illuminated the orchestra, two the 'orangerie,' and the remainder the adjacent grounds. * * * *

"The Grand Hotel, whose management constantly seek to apply everything that may contribute to the luxury as well as the comfort of their guests, had made one of the finest applications of the Jablochkoff system. Besides the ordinary 14 lights which have been used for five months in the court and in the reading room, they had placed along the immense balcony of the first story 32 richly ornamented candelabra—flags and different colored decorations were gracefully and sumptuously extended from one to the other. The lights threw upon the building and upon the Boulevard a brilliant effulgence, while the globes of the lights sparkled like a string of pearls. Over the main entrance stands of the national colors stood out in bold relief, forming one of the principal features of the fairy scene, which pleased the public so much that this illumination was repeated on the Sunday following the fête.

"Although no fête took place at the Trocadèro, yet, as this is one of the principal points of view in Paris, there was placed upon it a crown of 24 lights. An immense reflector threw beams of light upon the Arc of Triumph, the Opera House, the Tuilleries, the Seine and upon the boulevards. The public could hardly understand that this great light came from the distance of about 4 kilometres.

"Finally, for the first time the Jablochkoff system was used for the decoration of private residences. At No. 33 School street Mr. Leo Taxil employed six lights with fine effect.

"The total number of lights employed as above was 130, and this large number requires no comment, but shows the power at the disposal of the

Jablochkoff Company. In spite of the activity of our reporters it was impossible for them to obtain the exact number of electric lights, which, at hundreds of points, rivalled the sun. * * * *

"We learn that the number of Jablochkoff candles used in Paris daily is 425. In the provinces there are 426, making a total in France of 851. Outside of France there are about 823, making a grand total of 1674. If we suppose each post to be lighted four hours, the number of hours of lighting for all the lights employed would be 6,696 per day.

"At first the light cost 75 centimes (15 cents) per light, so that the total expense for the above lighting would have been 1,914,039 Francs (about $400,000); but, thanks to the progress realized by the Company, the *price* is reduced to 31 centimes (six cents) per light per hour. We can boldly defy the gas interest to show in its entire history a period of progress so rapid, so glorious and so rich in hope."—*L'Electricite, Aug. 5th.*

As may be noticed the above account is somewhat rose-colored, and by some may be deemed a little enthusiastic. The Journal from which it is taken is a most able one, and is devoted to electricity, upon which subject it is, technically speaking, the best of authority; but upon the subject of gas we should prefer an opinion of those a little more familiar with the subject. The opinion expressed above does not altogether coincide with that of many who have witnessed the effect of the electric light in Paris as used in street lighting. It has been our good fortune to meet many who witnessed the trial of gas against electricity in Paris during last winter, when the Rue de Quatre Septembre and the Avenue de l'Opera were each lighted, the former by large gas lights and the latter by the Jablochkoff system. Standing at the Opera House one could look down both streets, and the effect of each system could be noticed and compared. The testimony of most people, entirely disinterested as to both lights, has been that the gas light was the superior of the other, it being warm and cheerful, while the electric light was cold and cheerless. One gentleman described the globes of the latter as resembling "cold moons on a dismal spree."

It is to be borne in mind that in Paris these lights are all extinguished at midnight, and the gas lighted, for the reason that by that time the four candles in each lantern are exhausted, and the expense and trouble of renewing them at midnight, added to the cost of the additional candles themselves, would nearly double the cost of the light.

As to the expense it has been fully demonstrated repeatedly that, for street lighting, for equal amounts of light the large gas burners can furnish a better light at a less price than the other.

However, the Municipal authorities generally will be unwilling to pay even for the gas necessary for such gorgeous lighting, and it is only in special localities that it may be needed; but where it is needed, if a constant, reliable, steady, non going-out light is required as a matter of utility, then gas is the best and the cheapest. If a brilliant, dazzling, evanescent light is wanted in addition to gas, on special occasions, or in special localities, there is nothing to compare with the electric light.

We shall rejoice in seeing its extension, for its practical application can only be at such points as gas light has failed to supply satisfactorily, and the introduction of the electric light must result in good to the gas interest in two ways. It will lead to a demand for more light and, hence, an increased consumption which ought to produce, other things being equal, a reduction in price.

It will also arouse a more careful attention to the methods of burning gas which (generally speaking) are exceedingly defective to-day. It is at the burner that very often the best of gas receives such treatment that every effort at superior manufacturing is rendered almost negative.

[From the London "Journal of Gas Lighting" of Sept. 14, 1880.]

Electric Light in London.

The Commissioners of Sewers of the City of London had before them on Friday last whatever tenders for lighting the main thoroughfares of the city with the electric light their liberal invitation has been able to procure. The general public will have no means of knowing for some time what may be the practical outcome of this action on the part of the city authorities. The opportunity they have provided for the exhibition of electric light on the grandest scale yet witnessed has, we may be sure, been eagerly grasped by more than one of the enterprising companies which have been formed to extend and develop the various systems of lighting by electricity now before the public. In one respect the magnitude of the experiment to which the Sewers Commissioners stand in a measure committed is a satisfactory feature of it. Apart from the increased solicitude which the carrying out of such a considerable undertaking must bring upon the Commissioners and on those to whom the work is confided, there is the consideration that would-be contractors will be deterred from tendering at unprofitably low prices with ulterior objects, because the scheme is too vast to be used as an advertisement. This reflection is not without comfort to those who do not regard th new luminary with any favor, and who know where one of its weaknesses lies. Another weak point, which we presume the professional advisers of the commission will not overlook, is generally to be found in what its friends think the strongest recommendation of the light—its illuminating power. With most electric lamps the light they are supposed to be capable of affording needs to be calculated on the same basis as the amount of sulphur impurities in gas; the average of three days should be taken, or according to some witnesses, the maximum of any indeterminate period is more likely to be the advertised figure. We shall wait with much curiosity the report of the Sewers Committee on the proposals submitted to them. Whatever action they take will be fruitful of interest; while their failure to proceed, should that be the end of their preliminary essay, will be still more instructive.

[From the "London Journal of Gas Lighting" Sept. 21, 1880.]

Absolute secrecy is being maintained respecting the proposals received by the Streets Committee of the City Sewers Commission in reply to their invitation for tenders for lighting the principal thoroughfares of the city by electricity. We shall, however, be probably not far from the truth in stating that the competition for the favors of the city authorities in the matter of street illumination was not so brisk among the various organizations for supplying electric lighting as might have been expected. If this should prove to be the case, and the scheme should consequently be curtailed or abandoned altogether, it will probably be owing principally to the grand scale on which the city authorities wished to have their experiment carried out. They, perhaps, being accustomed to see any demand on the gas companies for more light easily met by the simple expedient of turning on more gas from sources to them unseen and apparently inexhaustible, may be pardoned for believing that the substitution of one method of lighting a few miles of streets for another, was merely a question of arrangement of the details of apparatus, and that nothing would be easier than to "welcome the coming, speed the parting guest." And their belief in the power of any known form of electric lighting to take the place of gas at any moment, and to any required extent, may have been fostered by the blatant advocates of the party in opposition, who are never backward in attributing the slowness with which the electric light is spreading, to anything but its own demerits, or the readiness of its own purveyors. But it will not surprise those conversant with such matters, if it should transpire that most of the respectable electric light companies find themselves unprepared to undertake more than a small, perchance a very small portion of the great work offered to them by the Sewers Commissioners. This eventuality would not at all deteriorate from the interest attaching to the experiment, provided that the competing parties are sufficiently numerous to make the exhibition important in the aggregate. There is one consolation which the Sewers Commissioners may lay to heart in case the electric light companies do not come up to time. The gas they have always with them, and if they want to get up a show of how streets can be lighted when the will to pay for brilliancy exists, they cannot do better than follow our previously expressed counsel—to add to their earlier design the exhibition of the various improved methods of street illumination by gas, to some of which they are no strangers. If electric light companies are backward, gas burner and lamp manufacturers are eminently the opposite, and any or all of them who have already distinguished themselves in the conflict of gas with electricity would, we are assured, be only too pleased to take a mile or so of streets and show what they can do in turning night into day. Such a course as that above indicated would, as we have already said, make the proposed experiment really valuable and very instructive, whether the whole of the scheduled streets are finally given up to the electric light or not. There are many other thoroughfares, in continuation of, or in contiguity to the streets named, in which a brilliant light would be quite as useful, and we venture to hope that the competition which the Sewers Commission have attempted to inaugurate in a somewhat one-sided manner, may be carried out at last on a fair and complete basis such as we have indicated.

The Electric Light and Lanterns.

A recent number of *Le Gaz* thus sums up the principal defects of the most renowned systems of electric lighting—*Jablochkoff Candle:* Too much scintillation; no arrangement for relighting automatically in case of extinction; too deep shadows beneath the lamp. *Werdermann Lamp:* Absorption of a great portion of the lighting power by the upper carbon; too frequent changing of the incandescent carbon; too much shadow. *Jamin Candle:* Too much noise; light too unsteady. *Regulators—Serrin, Lontin, Brush, etc.:* Too costly; too much shadow beneath; delicate manipulation. Therefore, remarks our French contemporary, there is still no really practicable system of electric lighting extant except the Serrin or Brush regulators for lighthouses or large works. Beyond this important negative result, the experience of four year's working of the electric light in Paris has produced absolutely nothing.—*Journal of Gas Lighting.*

Report of E. S. Chesbrough, Esq., upon a System of Sewerage for Newport, R. I.

ROOM 25, 175 LASALLE STREET,
CHICAGO, ILL., July 11, 1880.

The Joint Standing Committee of the City Council of Newport, R. I., on Roads and Highways :—

Gentlemen :—In accordance with the letter of your Chairman, of September 6, 1879, I have by personal examination of the ground, and by correspondence and consultation with Capt. J. P. Cotton, C.E., made myself familiar with the conditions of your city in relation to sewerage. These conditions are so fully set forth in Capt. Cotton's report that I need not repeat them here. He has clearly stated the necessity you are under of abandoning your present or natural outlet of sewage, if you would preserve your harbor, your beaches, and your water supply from offensiveness that must sooner or later injure the great reputation of your city as a watering place.

The plan recommended in providing for house, subsoil, and surface drainage is believed to combine economy of first cost and future maintenance in as great a degree as is attainable, consistent with making the first work required useful immediately after completion, and permitting the numerous smaller branches, which in the aggregate must be very expensive, to be built no faster than funds can be conveniently provided.

The question of sewage disposal which is still exercising the cities of the old world, as well as many of the new, may by future legislation be so settled as to prevent Newport and other cities from discharging the contents of their sewers into streams or tideways. Should that time ever come, all the sewers now recommended, except the main outlet, could still be made very serviceable. While speculation with regard to probable discoveries relative to the best mode of treating sewage, and to future legislation, must be uncertain, it is very satisfactory to know that very nearly all of what you may expend for present necessities could not, in any event, become useless.

There will always be room for doubt as to any plan being the best that could be adopted, either as a whole or as to its parts. There are differences of opinion among sanitary engineers, as there are among members of other professions. I can say in regard to your case that I have given it a very careful study and believe that under the circumstances in which you are placed the plan submitted by Captain Cotton is the most judicious to advise for your adoption.

Respectfully submitted,

E. S. CHESBROUGH.

NEWPORT, R. I., May 25, 1880.

To the Committee on Streets and Highways :

Gentlemen :—In compliance with your request that I should, with Mr. E. S. Chesbrough, C.E., of Chicago, Ill., as consulting engineer, prepare a plan of sewerage for the city of Newport, I would respectfully submit the following report.

J. P. COTTON, C. E.

REPORT.

Importance of Drainage.—The necessity for the removal of the waste water and fecal matter from our houses is so generally acknowledged that in all of the large towns of this country and in most of those in Europe systems of sewers and drains have been provided for it. Much has been written concerning "preventable diseases" and their origin—some going so far as to claim that they are all the direct product of the decay or putrefaction of filth ; others think there is no connection between filth and disease. But while this may be true, this fact, says the Massachusetts Board of Health, 1876, stands unquestioned, "that in some way or other the removal of it (filth) lowers the death rate of the community." The germ theory does not admit that filth can originate disease, but allows that filth greatly facilitates the propagation of disease germs, yet it is not the only means of such propagation, as pure water is known to spread the cholera germ with fatal effect.

The necessity of a system of sewerage in Newport has been felt and discussed for some years. The introduction of water has increased this necessity, for the quantity used has been greatly increased, and unless proper means are provided for carrying it off the ground about dwellings soon becomes sodden and unhealthy, converting the coveted supply of fresh water into a positive evil.

Natural Conditions.—Newport, situated on the south end of the island of Rhode Island, is about four miles in length from north to south, and three miles in width at its widest part. From the harbor, on the west of the most thickly settled portions, to the ocean on the east, is about one mile. This part of the town is an irregular ridge, having its greatest elevation, 100 feet, at Catherine Street. The natural drainage for the whole city is for the most part simple and direct, and generally on the shortest lines, and, with no question of the pollution of the shores, its sewerage would be a plain problem. But unfortunately the inner harbor is almost land-locked, and its principal dock front averages a mile from the tidal current of Narragansett Bay proper. It being on the west side of the city, and southwest winds prevailing in summer, it follows that in the season when decomposition takes place quickest floating matter is most obstructed, by unfavorable winds, from getting out of the harbor.

Easton's Pond, which bounds a portion of the town on the east, has but a tortuous, irregular, and intermittent outlet ; in the dry weather of summer it is completely stagnant. This receives the drainage of about 230 acres. South of this pond is Newport's beach, which it is obvious must be kept free from sewage pollution, for, as was said by Lewis Angell, M. Inst. C.E., Past President of the Association of Municipal and Sanitary Engineers, relative to discharging sewage into the clear waters of South Sea Beach, Portsmouth Harbor, England, "However carefully and efficiently the operation might be conducted, still sentiment and the mere fact of its existence would be most detrimental to the prosperity of the place." (See Proceedings, Vol. IV., p. 145.)

The same necessity for keeping this beach free from pollution will, in the near future, require that the discharge of all sewage must be diverted from "the cliffs" between the beach and the lower end of Bellevue Avenue.

That part of the town south of the harbor and west of Lily Pond, bordering on Narragansett Bay and the ocean, not provided for in this plan, is for the most part used for farming purposes. When it becomes necessary to provide sewerage for this part it can be done by using the lines of natural drainage into the bay and ocean. The city should, however, take some action to prevent the closing up and turning of streams from their natural channels in this and all other parts of the city. They will always be needed to convey storm-water, and should be improved for this purpose rather than obstructed.

The rock underlying the greater part of the city belongs to the coal measures. In the southwest part it is slaty. Commencing with Lime Rock in the harbor and extending to the south end of the Avenue (Bellevue) an upheaval has brought the granitic to the surface, thence to the northeastern boundary the slate predominates, with occasional sections of conglomerate.

The slate rock appears in the shores, forming bold cliffs, and occasionally crops out at the surface, but it is generally from 5 to 25 feet or more below the surface. In the granitic portion the surface is much broken and very irregular, with frequent exposures of rock of several acres in extent. This section offers greater difficulties in the way of improvement, and will doubtless, on this account, be the last to be used for residences.

The soil of Newport is for the most part a retentive clay ; in localities where the rock is covered to a considerable depth, and along lines of depression, there is generally a stratum of gravel next the rock. This is usually water bearing, and to it most of the wells have been sunk.

The retentive clay has prevented a general pollution of the soil, but it has at the same time preserved much of the filth that has been placed in it, so that this contamination, though slow, is going on, and must in the older parts of the town become serious.

Cesspools made in this clay require to have their contents frequently removed, but when dug to the gravel they are used for years without any expense for removal of contents.

Too often this fact has led to the digging of deep cesspools to the danger of the whole neighborhood, for certainly if their contents are not removed they must escape into the gravel from which the wells receive their supply.

During the construction of the sewer in Tanner Street, which for the greater portion of its length is in this gravel, the wells on either side of it for a distance of one hundred feet or more were drained. In some cases it was necessary to sink them deeper before a supply of water was obtained, in others a sufficient supply was had when the autumn rains filled the ground.

The water drained from this gravel stratum can be but "suspicious," and will, if its use is continued, at no distant day become absolutely dangerous.

Present Sewers.—There are in Newport about 9.65 miles of sewers of various kinds. These sewers have generally been built along the lines of natural drainage, to carry surface or drain water and the subsoil water. In some places the overflow of cesspools has been allowed to drain into them, but up to within six or eight years the policy has been to make them clean water drains only. With the introduction of water the demand has been general to have them used for waste water and kitchen drainage, and in some cases the water closets have been connected with them. Usually, however, these have discharged into vaults on the premises, to be emptied from time to time by the pail and bucket system, a system that is to the prejudice and injury of any community that permits it.

The sewers are of brick, or of brick covered with flag-stone, and earthenware pipe.

There are 7,000 feet of brick sewers, circular in form;
18,500 feet of brick and stone combined;
2,750 feet of pipe sewers, 15 inches in diameter;
7,000 feet of pipe sewers, 12 inches in diameter;
3,900 feet of pipe sewers, 10 inches in diameter;
2,300 feet of pipe sewers, 8 inches in diameter.

There are also about two miles of stone drains built to drain the cellers and road beds. These unfortunately have been used as sewers. They are a source of danger and should be replaced by pipe sewers as soon as possible.

The sewers built with a brick invert and sides and covered with slate flags are not suitable for carrying sewage matter in that the flags cannot be so laid as to prevent the escape of noxious gases. These will at an early day have to be replaced by pipe sewers.

Provision for ventilation has been made in but a few of the sewers thus far built. They have steep gradients, are self-cleansing, except in the case of the stone drains, which have no bottoms, and two brick ones that have been connected with shallower ones instead of continuing them with the increased depth to the outlet.

These sewers, with but two exceptions, have their outlet in the harbor. The exceptions are the Narragansett Avenue sewer, discharging at "Forty Steps," and the Kay Street drain or sewer, which discharges into the open gutter and through it to Easton's Pond.

Area to be Drained.—The area for which any system presented should provide is about 2600 acres, including some 350 acres in Middletown, 250 of which now drain into Bailey's Brook (from which the city's water supply is drawn), and about 100 into Hunter's Swamp.

The importance of preserving the water supply from probable pollution makes the necessity imperative for intercepting the sewage that would otherwise flow into it. Hunter's Swamp, containing 125 acres, is so low that storm tides flood a large portion of it; if any sewage matter is allowed to drain into it, it will in a short time become a nuisance that cannot be easily abated. It will be much better as well as cheaper to keep it out than to allow it to be polluted and then attempt to correct it.

Plans Suggested.—In 1878, by direction of the City Council, its Committee on Streets and Highways sent out to engineers and sanitarians the following circular:

CITY OF NEWPORT, R. I.

The Joint Standing Committee of the City Council on Streets and Highways.

July 15, 1878.

Dear Sir:—A strong desire prevailing in the community for improved sewerage, not only for the greater convenience of the public, but as a measure of hygienic importance, to preserve the well-known healthfulness of the city; to these ends the City Council have directed this Committee to present some general plan of sewerage (as far as they can do so without cost to the city), based upon the sewers now in use, a careful map of which has been made by order of the Council. The Committee therefore are desirous of obtaining the opinions of gentlemen of knowledge or experience who may be interested for the welfare of Newport, and believing that you are qualified to give advice upon this subject and are interested for the health and prosperity of the city, respectfully solicit any advice with which you may feel disposed to favor them, or the expression of your views verbally, and will be much gratified to receive any assistance in their duties.

Very respectfully yours,

NATHAN BARKER,
Chairman.
H. AUGUSTUS KAULL.
LEWIS BROWN,
SAMUEL SMITH,
WILLIAM P. PECKHAM.

In response to this, under date of Aug. 10, 1878, Horatio R. Storer, M.D., recommended that the outfall for a sewerage system should be in the current to the west of Goat Island or Coaster's Harbor Island, or west of Fort Adams. He made decided objection to emptying it into the Harbor or Easton's Pond. He did not state what territory should be included. He gave very full details as to what sewerage should accomplish.

Under date of September 6, 1878, E. S. Philbrick, C.E., called attention to the blunders made by other cities, and recommended the employment of one or more experts.

September 27, 1878, Prof. Wm. B. Rogers, Gen. George W. Cullum, Prof. Wolcott Gibbs, Prof. Josiah P. Cooke, Jr., Prof. Fairman Rogers, and Prof. Alex. Agassiz, in a report objected to the discharge of the sewage inside of Goat or Coaster's Harbor Island, or to any cove or bay near enough to bathing grounds to affect them in anywise. They proposed to drain on the eastern slope to the north, down to the 70 feet contour line, and on the south to the 60 feet contour, down as far as Brenton Street, possibly a district west of Coggeshall Avenue and north of Ruggles Avenue, and on the west side of the railroad to opposite Coaster's Harbor Island. For the territory south of Webster Street there was to be an outfall on Ledge Road. They suggested an outfall at Goat Island but on the whole they preferred that the main outfall should be on the west side of Coaster's Harbor Island. They suggested the use of a small engine to pump water from the bay to flush the Thames Street sewer.

They further recommended the employment of a competent engineer to work out a plan.

Under date of December 20, 1878, Mr. Orville Fisher recommended the pumping of the sewage and utilizing it for agricultural purposes near Coddington Cove. The sewage from the eastern slope to be pumped up by a separate engine and discharged into the west system and from thence pumped to the sewage farm.

A plan was also presented by Col. George E. Waring, Jr., but withdrawn. We are informed that he proposed to have the outfall on the west side of Coaster's Harbor Island, and pump the sewage from the low districts into an intercepting sewer along Spring Street through which it was to discharge by gravitation. His plan contemplated two pumping stations, one near the Depot and one near the junction of Thames Street and Wellington Avenue. No provision was made for the slope bordering on Easton's Pond.

Proposed Plan.—From what has been previously said under the head of "*natural conditions*" and from what has been quoted from those who have given the question much careful thought, it is evident that a system of sewerage to satisfy all the requirements must not discharge on the shores of the eastern slope, in Easton's Pond or in the Harbor. The natural drainage of the parts of the town most thickly settled is towards these places.

To meet these conditions without pumping seemed exceedingly difficult. While pumping is a simple and a very common way of removing the sewage in England and the continent of Europe, and soon to be in use in Boston, it is still desirable to avoid it, if it can be done safely. As was said by Mr. Angell, in describing the drainage of Portsmouth, England:

"Pumping is a constant expense; machinery fails at a critical moment or is unequal to the strain of an exceptional volume of drainage, whereas in a tideway a flatter gradient will always give relief twice daily for several hours together. Taking the balance of disadvantages, which is the province of the engineer to estimate, flat gradients, especially with a reserve of flushing power as at Portsmouth, is to be preferred to a dead end with outfall sumps dependent on pumps. Acting on this view supported by Sir John Hawkshaw, the author constructed the lower end of the system with very flat gradients."

In some cases, however, it is impossible to obtain efficient sewerage without pumping; but it is believed that Newport may dispense with it, at least for many years, and the system proposed has been arranged with this view.

Location of the Outfall.—The objections to an outfall at any point where the sewage would under any conditions pollute the "bathing beach" excluded from consideration any outfall that would not drain all of the east slope. It could not be allowed to discharge into Easton's Pond, and it was feared could not with safety continue long to be discharged into the Harbor. With these limitations in its location it must be in the current of Narragansett Bay or in the ocean to the south of the town.

Some observations were made with bottle floats at the proposed outlets, at Coaster's Harbor Island, at Goat Island, from the head of Long Wharf and and Ledge Road at the south end of the island.

These floats were bottles about five inches long of four ounces capacity, postal cards with my address printed on one side and a request to the finder to fill the blanks of day and location and drop into the mail on the other were placed in them.

About ninety of these were put out at the points named, at different times of the flood and ebb tide and on days when the wind was from different directions. A little more than one-half were picked up and the postals returned.

Of those put out from the head of Long Wharf (inside of Goat Island) all that were found, more than half, were found about the wharves.

Of forty-four let out on the outside of Goat Island but one was picked up inside of Lime Rock light in the inner harbor. The others were picked up on both shores of the bay between Castle Hill and seven miles up the bay. Of those let out at Coaster's Harbor Island about the same percentage was found and within the same length of shores.

Of those let off at Ledge Road all that were found, about one-half, were on a beach a few miles east of Watch Hill, nearly 20 miles away.

These observations alone do not afford a sufficient basis for exact conclusions, but they are certainly entitled to consideration, and taken in connection with well known facts give indications that may be safely followed.

The current outside of Goat Island and Coaster's Harbor Island runs at a rate of about 2 miles per hour on both flood and ebb tide.

Floating matter discharged at any of the points indicated, will in some cases be thrown upon the shore, but the great body of water, in which it will be washed and diluted, will prevent its becoming offensive.

The sewage matter discharged in suspension is relatively so small in quantity that it could not appreciably affect the immense volume passing into and and out of the Bay.

An outfall at either of the three points named would not probably prove objectionable. The choice must be determined by their probable efficiency and cost.

With the outfall at Ledge Road the area west of Spring Street and along Easton's Pond and the Point would not be reached without resort to pumping, besides it would involve a very large outlay before the present sewers could be diverted from their existing objectionable outlets into the harbor.

With the outfall on Coaster's Harbor Island and without pumping it would not be possible to effectually drain Thames Street without raising the grade of Thames Street, an expensive undertaking that would certainly be strenuously opposed.

An outfall in the vicinity of Fort Adams would involve a great expense in building, and would possess no sufficiently countervailing advantages over the proposed outlets.

An outfall in the current west of Goat Island would be equally effective with the others in delivering the sewage in a strong tidal flow where it would be rapidly diluted and borne away; it would be near the centre of the areas for which drainage is to be provided, thus securing the most favorable gradients, and it would begin to relieve the present sewers with a smaller outlet than any of the others. With this outfall the system could be extended to include all of the town where drainage is now required and all of the east slope from the lower end of Bellevue Avenue to beyond "Two Mile Corner," in Middletown.

By discharging all at one outlet we reduce the expense of the system, and if in the future some process is perfected by which the sewage can be profitably returned to the soil, pumping works will only be required at or near the outlet.

The proposed plan contemplates having the outfall in deep water outside of Goat Island and opposite the head of Long Wharf.

The harbor is to be crossed by an iron syphon pipe laid in a trench to preclude the possibility of injury from anchors, although it is believed that this precaution is not necessary, as vessels never anchor in this part of the harbor. The lowest point of this syphon will be at the wharf, and will there have a sump from which to pump out the contents of the syphon in case examinations or repairs should be necessary. This pipe is to be 2½ feet in diameter which is deemed of sufficient capacity for the ordinary sewage of a city of 30,000 innabitants. Provision will be made in the first construction for attaching another pipe to the end of the sewer if it should be needed.

The main sewer, equivalent to 5 feet in diameter, will be extended up Long Wharf to the City Hall; a main branch, 4 feet in diameter, from that point will be extended along Thames Street to Brenton Street, where it will intercept the sewage from Harrison Avenue; it is then to be extended up Brenton Street and along Spring Street to Ruggles Avenue, thence through Ruggles Avenue to Ochre Point Avenue, up this avenue to Narragansett Avenue, where it will receive the sewage from the sewer in Narragansett Avenue now discharged at "Forty Steps;" the present sewer to be retained as a storm water overflow.

The sewer along Thames Street is to intercept the sewage which now flows direct into the harbor. These sewers to be preserved for outlets for storm water. In building new sewers in the streets on the west slope, several might unite on Spring Street, and thus save the building of large sewers in each street.

Storm overflows are to be provided at four or five places along Thames Street between Long Wharf and Wellington Avenue. The semay be located at the least objectionable points. The storm water in the short streets with steep slopes may be allowed to flow over the surface and discharge direct into the harbor without danger of flooding any property of value.

From Ruggles Avenue and Spring Street a sewer can be extended through Spring Street and Bellevue Avenue and Ledge Road, draining to elevation 30.

From the main sewer at City Hall another main branch will extend up Washington Square to near the State House, in open cut; from this point to Redwood Avenue and North Kay Street it is proposed to tunnel, passing under Spring Street, Bull Street, Mann Avenue, Ayrault Street, and Cranston Avenue—the sewage from each of these streets to drain into it through pipes in the shafts. From Redwood Avenue it will be extended in open cut to or near Channing Avenue, where, at elevation 10, it will, when the necessity arises for it, receive the sewage of the east slope from a point not far north of Narragansett Avenue, and also the sewage from the west side of Bailey's Brook to the crest near Major Bull's, in Middletown. It will also receive the sewage from Broadway beyond Malbone Road.

The Tanner Street sewer will receive the drainage of the district to the south and east of Gibbs Street, and thence to include Miantonomi Hill above elevation (50). This sewer will continue to receive the storm waters of the natural drainage, of which it occupies the lowest line; its ordinary flow will be intercepted on Washington Square by the Tunnel sewer.

The district west of the Tanner Street district will be drained into the main outfall sewer on Long Wharf, by a sewer preferably along the line of the railroad, if the right of way can be procured; if this cannot be secured without trouble the main sewer should be located on Washington Street, up to Bridge Street, along Bridge Street to Third Street, and to be extended on Third Street out as far as the estate of Thomas Dunn, Esq.

It will be observed by reference to the accompanying map that the sewers described do not occupy the natural lines of drainage, but are planned to intercept the ordinary flow of sewers already built or that may be built on these lines that would otherwise discharge this flow at objectionable points into the harbor on the west, the Cliffs and Easton's Pond on the east.

Depth of Sewers.—The considerations that determine the depth to which the sewers should be laid vary with every town. The desirability of keeping the level of soil water as low as possible is an argument for deep sewers. When thus placed they give ample fall for house connections and secure basements against moisture; and where these are used for business purposes or for habitations the sewers should be so built. In Newport there is no such demand, nor is it likely that there ever will be, at any rate such a probability is so remote that we should not be warranted in providing for it at much expense.

To secure in all cases a fall sufficient for efficient house connections (not less than 1 in 60) the crown of the sewer should not be less than 9 feet below the curb. This would drain to 7 feet depth on the rear of a lot 100 feet deep. Sewers built on streets with steep gradients may have a less depth, and the fall required for house connections be obtained by carrying the outlet further down the hill; but this is not considered desirable, if it can be avoided.

The advantages to health claimed in lowering the level of the soil water is not gained unless this lower level be maintained. The dangers are rather increased if at one time the soil is thoroughly drained and then becomes sodden by defects or inadequacy in the drains.

It is manifest that without resort to pumping no sewers can be laid that will drain any section that lies below the level of high water.

Cellars should in no case be allowed to drain into public sewers where they (the cellars) are below the level of high water of spring tides, and even when placed at this level they are in danger of being flooded in storm tides. In such sections the sewers cannot be relied upon to keep the water level below that of high water. Dwellings with cellars that are liable to be flooded in storm tides, or that are so low that they cannot have cellars, are not suitable for residences, and the city should not accept a street the grade of which is not high enough to give cellars above tide.

Size of Sewers.—It is evident that the sizes of the sewers of a system must be proportioned to the amount of surface water that is allowed to reach them, added to the maximum water flow.

It is the practice in most cities of Europe and this country to provide sewers of sufficient size to carry off the waters of all storms, except extraordinary ones, a portion of which must be allowed to flow on the surface.

Where the sewage is pumped and then used in irrigation, or clarified by subsidence or chemical precipitation, as in many of the cities of England, and some on the continent of Europe, it is important to exclude as large a portion of the storm water as can be done, to save the expense of pumping and treating. The sewers may be built much smaller if they are to carry only sewage, and of course the cost will be much less; but there are some disadvantages in excluding the storm waters.

1st. In very wet weather our streets would be flooded, particularly at the foot of slopes.

2d. Unless special provisions be made by a separate system of drains, we should not effect the lowering of the subsoil water—one of the first objects in the introduction of sewers.

3d. We should deprive the sewers of the complete flushing that they would receive in each storm.

4th. The surface water from our streets at the beginning of storms is hardly less foul than the usual flow of sewage, and should be carried away by the sewers. J. Bailey Denton, F.G.S., etc., author of several sanitary works, in his "Lectures Before the School of Military Engineers, at Chatham," says: "It may be laid down as a rule that the surface waters should be excluded from the sewers to a very considerable extent," but "a sensible portion may be admitted with advantage." "If a proper regard is paid to economy in sewerage works, in no case will it be found advisable to exclude from the sewers the whole of the surface waters." In addition to

the ordinary sewage flow there will be a considerable quantity of water from springs and wet ground that will find its way into the sewers even when the utmost care is taken to make them tight. This, in many English towns, equals the amount of the water supply—that is, the discharge of the sewers is twice the amount of water supplied to the town.

The general practice in this country has been to build the sewers large enough to carry off one-half an inch of rain per hour, all that is supposed to reach the sewer in that time from one inch of rainfall, and to allow any excess to run over the surface. The sewer in Tanner Street was planned and built of this capacity. The sewer occupies the line of an old brook, in a section fully improved, where there are no opportunities for relieving the sewer by storm overflows, and where if the water were allowed to run over the surface it would prove a great inconvenience and damage to the property along its line.

In the plan submitted the main sewers are intercepting, and are designed, when the whole town is sewered, to carry, in addition to the ordinary dry weather sewage, one-fourth of an inch of rain in twenty-four hours. The sewer on Thames Street is to be provided with four or five overflows between the City Hall and Wellington Avenue. The sewers on the east slope, north of Narragansett Avenue, are to have overflows for storm water, so that the sewer through the tunnel will be of ample size when the whole area has been sewered.

The sewers heretofore built in the streets running west into the harbor are generally large enough to carry all of the surface water that reaches them.

Gradients of Sewers.—The invert of the outfall sewer at the head of Long Wharf is to be at one foot above mean low water; the gradient thence to City Hall will be one in two thousand, the same along Thames Street to Wellington Avenue, thence to Brenton Street, Spring Street, and Ruggles Avenue, one in five hundred. From the City Hall to and through the tunnel the gradient will be one in one thousand.

These gradients seem small, but they are not less than are in use in some important cities in England and in this country.

The main sewer in Bristol, England, has a gradient of 1 in 2310; one of the intercepting sewers has a fall of 1 in 890. These sewers were completed in 1874. The sewers of Portsmouth, England, commenced in 1865, have very flat gradients. One, 4630 feet in length, has a fall of but 6 inches to the mile. One, 4 feet in diameter for 2400 feet, has a fall of less than 1 foot to the mile. Another, 4 feet in diameter, has for 1800 feet a fall of one foot per mile. These sewers are kept clean by flushing. The flattest gradient of Providence sewers is 1 in 1000. In the new system of intercepting sewers of Boston the flattest grade is 1 in 2500. A sewer built in Brookline, Mass., in 1878, has a grade of 1 in 2500.

From these examples it will be seen that the gradients adopted are not so flat as some in use both in our own and other countries. Exactly what gradient is necessary to render sewers self-cleansing is not satisfactorily established. The conditions are seldom alike in any two sewers, so that we often find a sewer with a steep gradient requiring cleansing while one with a flatter gradient will be self-cleansing. The difference may be due to the fact that in the case of one the street is paved, while in the other it is a dirt road; or that there are fewer house connections, and consequently less water flowing in the sewer. In Providence, sewers with a grade of 1 in 50 have required cleaning, while others of the same size with a grade of 1 in 200 have been self-cleansing. No sewer is likely to be self-cleansing at its extreme upper end; for all such cases arrangements should be made for flushing.

It is proposed to provide means for flushing all of the sewers. Even those running down the steep slopes are to have small flushing tanks above the last house connection. The main outfall sewer on Long Wharf and the intercepting sewer on Thames Street are to be provided with means for flushing at each manhole, the manholes being located every 300 or 400 feet.

The sewers running down the west slope can be made to serve as flushing reservoirs for the intercepting sewer on Thames Street. Two flushing reservoirs or galleries are to be built near Brenton Street to be supplied from the springs there.

The sewer in the tunnel will serve as a flushing reservoir for the main outfall by having a gate near the State House. The necessary supply of water for doing this will be drawn from Wilbur's Swamp, where a constant and sufficient amount can be had at all seasons.

The sewers tributary to the outfall sewer will be provided with gates, to be closed when this sewer is being flushed, as far as may be found desirable.

Ventilation of Sewers.—The surest safeguard against sewer gas is to provide numerous manholes with perforated covers in the sewers, thus promoting free circulation of air through them at all times. When there is a large number of ventilating shafts along the line of a sewer, there is but little danger of any of them becoming a nuisance, or of the houses in the higher parts of the town being troubled from the forcing of traps by gases driven from low-level sewers in time of storms. To prevent this still further, however, the sewers running down the hill should be provided with flap valves in the first manhole above the intercepting sewer, and with means of ventilation at the flushing tank above the last house connection. If the sewers are properly built and fully ventilated, and flushed when necessary, there should be no danger from sewer gas.

House Drains.—It matters not how well sewers may be planned and built, if the house connections are not properly laid serious trouble will be experienced. When the sewers are built slants should be built in them for each lot, and the drain carried to the curb line; and when the house drain is laid it should be done under the inspection of a competent person.

The practice of cutting into either pipe or brick sewers to make connections is often the cause of dams of pieces of brick, pipe, etc., and consequent deposit. Connections should be made only under special permits, and by competent mechanics.

The usual size of house drains is 6 inches in diameter; they should be laid with a fall of not less than 1 in 60. Great care is required in laying these, if serious consequences are to be avoided. No rules can be laid down that will take the place of intelligent, faithful, and efficient workmanship.

Accompanying this report is a map of the city and a portion of Middletown, being the entire area for which the proposed system provides. It shows the drainage districts. A diagram* of the main outfall and intercepting sewers, showing the depth of cutting, gradient, and storm overflows is also given.

[See map, p. 175.]

Cost.—The system of sewerage here presented is for the main outfall sewer with the main intercepting sewers, which, when built, will intercept the flow of the present sewers, and all that will be required for many years. The cost of the main sewers only is estimated for. Much of the area for which these sewers will provide is as yet used for agricultural purposes only. Sewers cannot be planned until this is laid out, by which time it will probably be determined how much water the sewers should carry—an important matter in determinining their sizes and cost. Again, any estimate for these at this time would be of little value when they would be built, because of the changes in the cost of materials and labor likely to take place.

Estimates.

1800 feet of 2½-ft. cast iron syphon pipe, at $12	$21,600
2000 feet of outfall sewer on Long Wharf, equivalent to 5 feet in diameter, at $8	16,600
6000 feet of intercepting sewer on Thames Street, 4 feet in diameter, at $6.50	39,000
600 feet of sewer on Washington Square, 4 feet in diameter, at $7.	4,200
2900 feet of sewer in tunnel from Washington Square to Kay Street, 4 feet in diameter, at $15	43,500
26 manholes, at $30	780
2 flushing reservoirs (9000 gallons each) near Brenton Street, at $750	1,500
Storm overflows, five on Thames Street and two on Long Wharf, at $600	4,200
Total	$130,880

Respectfully submitted,

Jos. P. Cotton, C.E.

The Telephone in Coal Mines.

London *Iron* has the following upon this subject:—"There are difficulties connected with the application of electric lighting to coal mines, which, however, are not insuperable; but there can be none to the use of the telephone as a means of communication between the miners and the upper world, as well as with the authorities underground. The advantages of the telephone would be manifold in the ordinary routine of the pit. In the only colliery in which, we believe, it is in use, the engineer above is able to satisfy himself as to the condition of the pumping machinery in the parts of the works the most difficult of access, by merely listening to the sounds given out by the valves, etc., independently of the advantage of sending immediate advice or instructions on an emergency; and it is evident that, in case of an explosion, were the wires properly protected, the communication they would afford with workmen suddenly entombed alive would be of the utmost importance.

On this last account the establishment of means of instantaneous communication with those employed in mines has, we are informed, been already enforced by one of the Australian Legislatures."

* This diagram not printed.

Water-Proof Coverings.

By F. Collingwood, Member of the American Society of Civil Engineers.

Read at the Twelfth Annual Convention, May 25, 1880.

As a contribution to the general subject of the use of asphaltes, bitumens, etc., the writer would offer the following bit of experience:

As it is intended that the arches of the approaches of the East River Bridge shall be used for mercantile purposes, it became necessary to cover the concrete over the arches with some protecting substance, which should keep out all dampness from the masonry. On inquiry among persons engaged in such work, a great diversity of material was offered, and each urged as the best for the purpose.

It was accordingly decided to ask bids generally, each bid to be accompanied by samples for testing.

In deciding on the tests, the following requirements were had in view:

1st. That the covering should be impermeable to water at all temperatures, and

2d. That it should be permanent.

It is evident that there is little danger of failure at high temperatures, but at low temperatures cracks may develop from contraction or shocks, allowing water to pass through. The tests on this point were, to make some wooden moulds with grooves about 2 feet long, with enlargements at the ends, so as to give a shape like an eye bar, and fill them with the mixture. These, with some flat pieces of the material, were exposed to a freezing mixture for 48 hours. Some of the long pieces cracked under this test. After freezing, the plates were first tested with a loaded point for penetration, and then dropped a short distance to see whether they would break. In this way a fair idea of the respective hardness and brittleness was obtained, and also (by careful measurements) the relative contraction.

After this the specimens were exposed to heat, to see their behavior under a high temperature.

The next tests were for durability, and proceeded upon the assumption that in process of time destruction must occur, if at all, in two ways:

1st. By the gradual evaporation at ordinary temperatures of the volatile oils contained in the water-proofing material, and which give plasticity to the mass, thus causing them to be crumbly and absorbent, as witnessed in coal tar roofs. The test for this was to weigh with delicate scales a small mass of the material, and expose it in a sand bath to a temperature of 212° for 48 hours, noting the percentage of loss.

The second possible cause of failure was considered to be absorption of water, which by freezing and thawing would eventually cause disintegration. For this test carefully weighed specimens were soaked in water for 48 hours, taken out, wiped carefully, and reweighed to determine increase in weight.

A third possible cause of deterioration would be looseness of structure, causing rapid abrasion under passing loads, but this would be determined by the second test above.

The various samples offered may be classified as follows:

1st. Alternate layers of coal tar and felt.

2d. A mixture of soapstone, crude petroleum, and resin.

3d. Trinidad bitumen (refined) and coal tar, with an admixture of sand.

4th. Asphaltic mastics consisting of various mixtures of Val de Travers or Limmer asphaltes, with Trinidad bitumen, residuum oil, limestone, sand, etc.

5th. Trinidad bitumen, with paper or felt, in consecutive layers.

6th. Trinidad bitumen (refined), mixed with about 10 per cent. of residuum oil, put on in consecutive layers.

The tests showed that all of No. 1 were totally unreliable for permanent work.

No. 2 is an admirable fire-poof material for roofs. There was a loss of one-half per cent. by boiling, however, and the price was too great.

No. 3 absorbed 3 per cent. of water, and was evidently poorly prepared.

No. 4. Of these the best samples were excellent, but were rather hard at low temperatures. Of the poorer ones (those most adulterated), some failed by cracking, showing brittleness, others by absorption, taking up as much as 4½ per cent. of water. The best were too expensive.

No. 5 were decided against, on the ground that no paper layers could be made continuous, and there seemed no reason for inserting a foreign substance which had no protective power of its own.

No. 6. A mixture of 20 per cent. residuum oil and 80 per cent. Trinidad bitumen was found to be too soft. The residuum oil or petroleum wax is that product of the distillation of petroleum which passes over at temperatures between 800° and 900° F. Reducing the oil to 10 per cent. gave a mixture neither too soft when warm nor too brittle when cold, entirely non-absorbent, and losing nothing when boiled. It was theretore decided that as the price was less than that of any other acceptable sample offered, the bid would be accepted, to put down three layers having a total average thickness of half an inch.

The lesson to be learned from these tests in respect to the use of such materials in road making is this, that it is possible to take a piece of material from a street (a very small piece will do if chemist's scales are used), and determine at once whether there is a reasonable probability of its being of a lasting character. All experience goes to show that compressed asphalte cannot be durable unless well compressed; and the absorption test ought to reveal the physical condition of any specimen as to porosity. A tensile test, by comparison with known mixtures, would reveal something also as to adulteration of the mixture by an excess of grit or earthy material. One bidder put in peat for some purpose best known to himself. Of course, no person would recommend the mixture adopted as suitable for road making; it can only be used where covered from the sun's rays by an external covering of some thickness, for the express purpose of keeping out water.

This experience is given as one method—in the present case a very successful one—of deciding among a lot of bids having apparently few points in common on which to base a decision.

Edward P. North.—The interesting experiments detailed by Mr. Collingwood may be supplemented by a notice of the tensile strength of some samples of asphaltic mastic (No. 4, mentioned above), and of a bituminous mastic known as Filbert's vulcanite.

The asphaltic mastic was made from Val de Travers asphalte, melted in the ordinary refined Trinidad bitumen, with the addition of about 50 per cent. of clean silicious grit of the size of a pea.

The vulcanite is identical with that tried in Fifth avenue, between Twenty-fourth and Twenty-fifth streets, in August, 1879, and is composed of 14½ gallons of refined Trinidad bitumen, 7 cubic feet of find sand, both heated to 300° F., and 1 to 1½ gallons of a mixture of cement, limestone dust, and sulphur, all mixed in a horizontal pug mill.

The test pieces were one inch square, and were broken on a cement testing machine that only registered to 400 pounds.

Four samples of the vulcanite were broken at 120, 140, 185, and 230 pounds. Five samples of the asphalt mastic were broken, one at 352 and one at 400 pounds, the other three stood 400 pounds for over a minute, and broke with an added weight of from 20 to 50 pounds. All the test pieces were immersed for over an hour before the breaking in ice-water; the temperature of the room was 85°.

The asphaltic mastic probably had more than twice the tensile strength of the vulcanite, and would be less liable to crack from changes of temperature.

This mastic, without the addition of grit, is largely used in France for covering arches, casemates, and powder magazines, with very satisfactory results, as the mastic yields to the settlement of the masonry without cracking.

It may be doubted if the test proposed by Mr. Collingwood would be a valuable aid in selecting a paving material, as newly laid compressed asphalte would not show as well under it as the mastic, yet experience has shown that it is much more durable than the latter for wheelways—so much so that the Limmer Company, of London, are replacing their mastic pavements with compressed Sicilian asphalte, and it is doubtful if asphaltic mastic will wear better than the best of the bituminous mastics as now laid, particularly under rapid traffic in cold weather, but the asphaltic mastic would be the best absorbent of the two.

F. Collingwood.—In continuation of the discussion of "water-proof coverings," I have a few additional facts to offer.

Our work, as far as it was concreted, was covered during cold weather with the mixture mentioned above, namely, refined Trinidad bitumen with 10 per cent. of residuum oil. It was then expected that the stone paving would be laid early in the spring, and a thick layer of sand was spread over it. Instead of this, owing to delays, the pavement has not yet been laid, (July 24, 1880), and the whole has been exposed to the hot weather of the past few months.

The temperature has, under the circumstances, been sufficiently high to cause the bitumen to rise in places through the sand, and to flow to a moderate extent.

This experience shows that it is necessary to attend to the upper limit of temperature as well as the lower. I am now inclined to think that the bitumen would be better without any oil. With the full thickness of paving and sand we expect to put above it, the temperature will probably not be high enough to disturb it. This is, no doubt, the reason for the introduction of felt and paper in its use over roofs and sidewalk vaults.

There is a practical difficulty in applying it to the inside of drains. When hot enough to insure thorough adhesion to the walls of the drain, the smoke is so thick that the workmen cannot see what they are doing. The soap solution would probably be the best application in such locations.

The asphaltic mastic without grit is unquestionably a good material, as a number of such samples when tested showed no absorption.

This would have been selected in the case of the bridge work had not the price been higher than that of the bitumen. It was not considered enough better to warrant paying the considerable difference there was in the bids.

Apparatus for Determining the Percentage of Nitrogen in Coal Gas.

To the Editor of the American Gas Light Journal:—

Dear Sir—Inquiries having frequently been made for a simple way of determining the percentage of nitrogen in coal gas, permit me to call your attention to a new and very effective apparatus for reaching this result, devised by Dr. A. W. Wilkinson, Chemist to the New York Mutual Gas Light Company, as an addendum to his volumetric apparatus, which was noticed in the JOURNAL some time since, as manufactured by the Goodwin Gas Stove and Meter Company, of this city.

Nitrogen is a non-combustible gas, and seriously interferes with the quality of the light that gas free from it is capable of. The sources for the introduction of this destroyer of perfect combustion are numerous about gas works—for instance, leaky retorts under vacuum, or any insecure joint between the exhauster and retorts. When air is taken in through a heated leaky retort, the oxygen is burned up, leaving the nitrogen in excess of that indicated by the amount of oxygen shown in an analysis by the volumetric apparatus for air—the composition of air being one part oxygen to four parts nitrogen. Every coal gas maker ought to know that the introduction of air is at the expense of light, and it is to enable him to detect the quantity of nitrogen present that I now describe the new apparatus in use at the works of the New York Mutual Gas Light Company. The previous manner of testing for nitrogen necessitated the services of an expert chemist and costly apparatus, and it was an operation requiring much time and involving considerable expense. The new apparatus is simple, effective, and economical, and easily manipulated after limited practice by any intelligent person, and a result reached in a very few minutes which, although not absolutely correct, approximates so closely to the actual quantity present as to serve all practical purposes of gas making.

Description of Apparatus.

It consists of a tank or well about 6 inches in diameter and 2 feet deep, fitted with a waste pipe at bottom, and set in any laboratory table and filled with water. A stand supports a graduated tube with stopcock at top, and divided into 100 equal parts from the top downward. This tube is the same as used in the volumetric apparatus hereinbefore mentioned, with the exception of two platinum wires soldered into the glass tube near the top, as is usual in the eudiometer tube. A funnel is ground to fit the tip of the tube.

Manipulation of Apparatus.

Clamp the tube in stand and raise it nearly out of water. After removing funnel, slip a rubber tube upon tip of tube and draw water up to completely fill tube; then close stopcock and the tube is full of water and ready for the introduction of the gas to be examined. Connect the tip of tube to the pipe in which this gas is flowing by means of a piece of rubber tubing; open the stopcock upon tube carefully and introduce 10 measures of coal gas, and afterward introduce 10 to 15 measures of oxygen gas. It is important to be exact in measuring these volumes. Oxygen gas can be made by decomposing chlorate of potash in a small flask, as is customary in the production of oxygen; or, for convenience, a cylinder of oxygen in a compressed form could be procured from the manufacturers of this article. This oxygen may be introduced at the lower end of the tube, passing up through the water.

The tube is now lowered part way into the well, funnel adjusted to tip of tube, and partly filled with water, care being taken that all bubbles of air in this funnel are expelled. A small quantity of the water in the funnel is allowed to flow down the tube, which causes the gases to become intimately mixed. The tube is now lowered down into the well to the level of the gas in same, and ready for combustion, which is produced by passing an electric spark through the small wires soldered into the tube, from a small battery, by the aid of a Ruhmkorf coil, or any other convenient mode of generating an electric spark. The explosion, although quite active, is not sufficiently severe to expel any portion of the gas from the tube. The reduction of volume of gas in the tube is now quite apparent—in fact, all the carbon and hydrogen compounds have been burned into carbonic acid and water, leaving the excess of oxygen and nitrogen contained in the gas, as also the carbonic acid formed by the combustion.

The carbonic acid is now dissolved out by introducing into the funnel a small quantity of solution caustic potash, and allowing it to gently flow down the tube. This is followed by a solution of pyrogallate of potash, which absorbs the oxygen, leaving the nitrogen. This volume of nitrogen multiplied by 10 gives the percentage of it in 100 measures of gas examined.

Certain corrections have to be made in the final reading of the graduated tube, owing to fact that the oxygen is not always pure when made in a flask, a series of tests made in the volumetric apparatus before mentioned showing 1 part nitrogen to 16 parts oxygen, which fact must be taken into consideration in determining the volume of nitrogen, otherwise the gas under examination would be charged with more nitrogen than actually existed.

If a cylinder of oxygen is used, subject it to analysis, and the percentage of nitrogen found will serve as long as the contents of the cylinder continues in use.

This analysis of coal gas shows the exact amount of nitrogen present, no matter from what source it comes, and the time required for a complete analysis is less than that consumed in the perusal of this communication.

Respectfully yours,

E. S. T. KENEDY.

New York City, September 15, 1880.

Railway Carriage Lighting.

The question of the efficient and economical lighting of railway carriages is one which has occupied attention ever since railways were established, and of late years considerable ingenuity has been exercised in attempting its solution. Hitherto this has not been satisfactorily accomplished, but the system we are about to notice would appear to meet all the requirements of the case, and to offer a simple, efficient and economical means of railway carriage illumination. The system is that Mr. Julius Pintsch, which has met with marked success in Germany, where it was first introduced, and it is now giving equal satisfaction in this country on several lines of railway. In this system the illuminating agent is oil gas, which is stored and used under pressure, and the manufacture of which and its application to carriages on several lines of railway we have recently inspected. The manifest deficiencies of the old oil lamp long since led to the adoption of coal gas on our metropolitan lines, and its use has there been attended with a certain amount of success, but still leaving much to be desired. As an illuminator coal gas is far in advance of the oil lamp, but its use involves cumbrous gasholders on the tops of the carriages, while the comparatively short supply of light which at the best can be insured without renewal, the waste of gas in charging the holders on the carriages, and the frequency of that operation constitute drawbacks which it would be most desirable to avoid. Several inventions have been introduced with the view of burning coal gas in railway carriages under improved conditions, the main features of which are the raising of its illuminating power and the storing and burning of it under pressure. Although some of these devices, which have been noticed by us, promise well, none of them have as yet passed from the region of experiment into the domain of practice. Hence, to a considerable extent, railway carriages still continue to be lighted on the old oil lamp system, which system has long since been superseded in almost every other direction. It was the many difficulties by which Mr. Pintsch found himself surrounded when endeavoring to produce a satisfactory system of lighting by means of ordinary coal gas that led him to investigate the subject in another direction, and finally to perfect and adopt the oil gas system which bears his name. In this system the gas is produced mainly from shale oil refuse, which is obtained from the paraffin works in Scotland, and the most recent examples of the application of the system are those in connection with the District and the Southeastern Railways, the oil gas works being situated at the Mansion House station on the former, and Rotherhithe on the latter line. Similar works are to be found at Stratford, on the Great Eastern Railway, and at Baker street and Hammersmith, on the Metropolitan Railway. By the courtesy of the directors of the company we recently paid a visit to the works at Hammersmith, which are very compact and complete, and over which we were conducted by Mr. Hugo Pischon, the secretary and manager of the company, whose offices are at Metropolitan Buildings, New Broad street, London.

The shale oil refuse is distilled in retorts, for which purpose there are four coupled furnaces, each containing two cast iron ⏢-shaped retorts 10 inches deep, and placed one above the other. The oil is fed into the upper retort, where it is evaporated, and the vapors pass thence into the lower retort, where their complete decomposition is effected in the presence of a greater degree of heat than is found in the upper one, the lower one being directly over the furnace. The tar is conveyed away as it is formed, and is used on the line for general purposes. The gas is conducted from the retorts to the condensers, and thence it passes through a washer and two purifiers to a meter. From the meter, where the quantity of gas produced is registered, it is led to a gasholder. The gas thus produced is only temporarily stored in this holder, its final destination being four wrought iron cylindrical store holders, where it is retained for use under pressure. And

this constitutes the important feature of Pintsch's system, that the gas is stored under considerable pressure on the works, and it is also used under pressure in the railway carriages, which, it appears, cannot be satisfactorily done with ordinary coal gas.

The compressing pump has two compressing cylinders of different sizes, the larger being 7 inches and the smaller 4 inches in diameter, both being water jacketed. These pumps are placed on the same frame with the engine, which has a 12-inch cylinder with a 12½ inch stroke, and is run at 25 revolutions per minute.

The gas is drawn from the gasholder into the larger cylinder, where it is compressed to four atmospheres, or 60 lbs. to the square inch. It then passes into the smaller cylinder, where it is further compressed to ten atmospheres, or 150 lbs. per square inch, at which pressure it is delivered into the store holders. These holders are 18 feet long and 4 feet in diameter, and at atmospheric pressure are capable of containing 250 cubic feet of gas each, or 1,000 feet in all. This, however, is increased to 10,000 feet by compression, which is the absolute quantity stored, and which is always ready for use.

From these store tanks the gas is conducted to the filling posts, six of which are placed in the 6-feet way in the station at Hammersmith about a carriage length apart. A coupling hose for connecting the filling posts with the carriage completes the arrangement so far. The compressed gas is stored for use in the carriages in a couple of wrought iron cylindrical receivers 6 feet long and 20 inches in diameter, which are connected together by a pipe, and are fixed to the under framing of each carriage. These receivers are filled with the gas from the filling posts by means of the coupling hose, and it is there stored for use at a normal pressure of six atmospheres, and they contain a charge sufficient for use for 36 hours, unless a shorter time is desired. From the receivers the gas passes through 3-inch pipes to a regulator, by means of which a uniform pressure is always maintained at the burners. This regulator consists of a cast iron conical vessel 12 inches in diameter and 6 inches high, the upper part of which is closed by a gas proof membrane. To the center of this membrane is fastened a rod with a movable joint, which is placed in connection with a special valve. The gas passes from the receiver into the regulator until the tension of the membrane is sufficient to actuate the valve through the lever, the further influx of gas being thus automatically stopped. As the gas passes away to the burners for consumption, the deficiency is continually made good, and the action of the regulator is so perfect that the flame is in no way affected by the vibrations of the carriage. A ¼-inch pipe conducts the gas to the burners, which are conveniently placed in the carriage roof, and this is the largest pipe used in the carriages. There are means for extinguishing all the lights in a carriage at the same time, and each carriage is further fitted with an arrangement for turning all the lights down to a mere glimmer at once, and of turning them up again. This is very useful in cases where the train only requires to be illuminated intermittently, such as when passing through tunnels. Owing to the gas being consumed under considerable pressure the lights, although turned low, do not become extinguished when the train moves.

We have been afforded opportunities of examining into the working of this system on several of our leading railways, the latest application being on the southwestern trains, where it has recently been adopted, after having been on its trial for some time past. The light is brilliant and steady, and is in fact all that can be desired for railway traveling. The system has also been adopted by the Southeastern Railway on a broad basis, the entire tidal and mail service, include the post-office van, as well as some of the splendid new stock for suburban traffic, being the first to be thus fitted. It is now possible to run nightly from London to St. Petersburg—saving on the Channel passage—in trains lighted on Pintsch's system, which has been largely adopted on Continental Railways, the express trains from Calais and Ostend having been thus lighted for several years past. As a matter of fact 19 per cent. of the passenger carriages on the German railways have already been fitted with this light; while in England the carriages running and in course of being fitted upon Pintsch's system amount to more than 1,000 already. Considerable experience, which was preceded by searching tests, has shown that neither in manufacture, storage, nor use are there any points of danger connected with Pintsch's lighting system. It has also shown that a permament gas of very high illuminating power is produced, and this permanency is a very important feature when taken in connection with its storage and use under a high pressure. With regard to the question of cost, we learn from the railway officials that there is a marked saving as against ordinary gas, its superior illuminating power being very distinct as regards coal gas, while it simply leaves the oil lamp nowhere. Pintsch's oil gas is said to cost about one-tenth of a penny per hour per lamp, burning 7-10th of a cubic foot, and not quite a ¼d., including interest on capital outlay. The experience afforded by its use on the Metropolitan Railway goes to show the cost to be about 30 per cent. less than that of non-compressed coal gas lighting.

The reason why compressed coal gas cannot be used for this purpose is that its illuminating power is almost entirely destroyed by compression. As far as the systems of carburetted or enriched gas have gone they have not succeeded, for the reason that, so far as we are aware, no carburetted gas has as yet proved to be permanent, and, not being so, it deteriorates by being kept, and thus entails waste. Condensation, however, even at very low temperatures, appears to be a thing unknown in Pintsch's gas, and hence its usefulness for long journeys and cold countries.

As an instance of the permanent character of this gas and its non-liability to condensation, we may mention that the receivers of the saloon carriage of the Prince of Wales on the Great Eastern Railway were filled with gas, and the carriage was used four or five times during four months without the receivers requiring to be refilled. It will thus be seen that the system affords a reasonable and practical solution to the hitherto somewhat difficult question of lighting railway carriages efficiently, safely and economically.—*Iron.*

[From the London "Journal of Gas Lighting."]

Southwest of England District Association of Gas Managers.

The Sixth Half-Yearly Meeting of this Association was held at the gasworks, Southampton, on Tuesday, the 14th ult., under the presidency of Mr. S. W. Durkin, the president.

Mr. T. Stone (Weymouth) then read the following paper on

THE EXTENSION OF GAS SUPPLY TO THE MASSES.

I believe there is no matter connected with our profession which has been so much neglected by gas companies as that which forms the subject of my paper. Look where we will, we find that nothing pays so well as catering for the masses of the people, and we have the humiliation of noting that almost everywhere, where the people are peculiarly cared for in commerce, it is by those who have to combat with keen competition, and who possess no monopoly such as we, or most of us, have.

To my mind this is highly discreditable, as it seems to suggest that nothing is cared for but satisfactory dividends to shareholders where the fault lies at the door of the directors, and a love of ease where it lies at the door of the manager. In saying this I willingly grant that much increased labor, anxiety and responsibility rests upon the manager, which he has no manner of interest in assuming, except a high sense of duty in carrying out the true principle of a regulated monopoly in the spirit in which it was designed and granted by parliament, which appears to me to consist in this—that always assuming fair management, a good dividend upon invested capital is secured, or practically so, by Parliament, so long as certain duties to the public, which Parliament imposes as the penalty of monopoly, are faithfully discharged. I need only refer you in proof of this to numerous clauses in Acts of Parliament under which most of us are working; they are numerous, explicit and distinct.

Now, how do we discharge those duties to the public? Mainly by supplying those persons with gas who apply to us for it. "Well," it may be said, "that is just what tradesmen do." Just so; but they do infinitely more; they employ representative men to go out and solicit business. I fancy I hear some one say, "What! gas companies? I go out *touting* for business? Not if I know it." Well, I confess I see no objection to it, where time and opportunity admit of it, such as in small places where the manager's time is not otherwise fully employed, and where his time is fully employed, then, like a tradesman, he may consider whether it is not well to employ a representative to perform the service. Successful men of business have done so, and why should not I? In addition to personally soliciting business, tradesmen advertise freely. I admit that here we are, as a body, redeeming our characters, for we are beginning to advertise our wares, and in some measure to attract the attention of those for whom we exist; but hitherto this has been on a most meagre and limited scale, confined mostly, if not entirely, to large companies or corporations owning gas works, and who have had enterprise enough to organize exhibitions of gas stoves and other apparatus, which in the principal districts have resulted in so much increase of business, and which has had the double effect of reducing the price of gas to the public and consolidating the dividends of the companies in the one case, and the reduction of the improvement or sanitary rates in the other; which latter case I cannot forbear characterizing as an illegitimate use of profits which have been derived from a part for the benefit of the whole of the public.

About twelve months ago I conceived the idea of scheduling every house in my district, of whatever quality, which had no supply of gas, believing that, if a householder, however poor, could afford to use artificial light at all, he could afford to use gas, as being at once the most cleanly, convenient, comfortable and inexpensive lighting agent. Accompanied by an assistant, I accomplished about one-half of the district, and as I had no opportunity of completing the whole before my then next meeting of directors, I broached

the matter to them, but did not find sufficient encouragement to warrant my proceeding with the remaining half of the district; only the sense of having done what I believed my duty prevented my regretting that I had put myself to so much pains, weariness and labor which it involved.

I discovered in my perambulations that in about half, or perhaps something more than half of my district, there were 739 houses having no supply of gas; and assuming they all had a supply, I put a very low estimate upon them, viz.:

1	at	£30	0 per ann.	4	at	£1 15	per ann.
72	"	4	0 "	92	"	1 10	"
20	"	3	0 "	45	"	1 5	"
1	"	2	15 "	341	"	1 0	"
21	"	2	10 "	114	"	0 15	"
27	"	2	0 "	1	"	0 10	"

The gross amount was £1,140 5s., and it cannot be supposed that once these houses obtained a supply of gas they would confine their consumption to such narrow limits as those indicated; but I preferred to err on the safe side. Had the whole district been so scheduled, I have no doubt I should have tabulated at least 1,200 houses, estimated to produce a revenue of £2,000 per annum. I do not for a moment suppose that, however strenuous the endeavors made to extend the supply in this direction, it would receive the favor of every householder, but I do believe it would of a very large number—quite sufficient to warrant gas companies in making the attempt.

I propose, in the first place, to offer householders every facility to purchase fittings at a very cheap rate—at prime cost if necessary—also gas cooking and heating stoves, and where they will not purchase them let them out on hire at a rental sufficient to cover interest on outlay and depreciation of plant. This I would extend to every description of gas fittings, and stoves for heating and cooking; but for gas engines it would propably be impracticable, in consequence of the great cost of those engines. I contemplated, had my directors supported me, making an experiment with a terrace of 22 workmen's cottages above the average of respectability. I estimated that I could erect gas fittings for lighting three rooms—kitchen, sitting-room and bed-room—and put in a small cooking stove capable of cooking an artizan's family dinner, at a prime cost of 40s., upon which I proposed to charge 10 per cent. interest; then the charge for meter hire, 4s. per annum; making altogether a fixed charge of 8s. per annum. There would be only one light in use at a time, which I reckoned at 3 feet per hour for an average of three hours per night=3,285 feet per annum. For the stove I estimated 100 feet per week for 26 weeks=2,600 feet; together, 5,900 feet, or roundly 6,000 feet at 4s. 6d. per 1,000=£1 7s.; add 8s., the fixed charge, and we get a sum of 36s. per annum, or 8d. per week throughout the year. I am sorry I am unable to compare this with the probable cost of oil, spirit or candles, which cannot surely be much less than the sum named; and it must be remembered that, by the use of the stove, the total fuel account is saved for 26 weeks in the year, which would alone, I imagine, amount to the gross annual cost of gas for every purpose. That the masses of the people would hail any measures which would bring gas within their reach I do not doubt, for while spirit lamps have been brought to a high state of perfection they are often the cause of much damage to property, and not seldom of loss of life, while at best they are very troublesome to trim and clean daily, and the number of glasses broken is legion.

I presume none of us would object to the great increase of revenue such an extension would bring us. What, then, are the objections to such an extension? The gravest I have ever heard is that it would lead to a large increase of bad debts, and that the trouble of collection would be enormous. I will grant all this to a large extent. Doubtless the trouble would be great, but, after all, that is only a matter of cost—either an increase of salary to the collector, or the allowance of some assistance. Bad debts would probably be more than were averaged before, but I believe myself not to anything like an extent to warrant the quashing of the matter.

I thought some years ago of endeavoring to get a meter made which should be simply read, and be capable of registering the hundreds and tens, and having them read monthly for small houses, and the payment made in smaller amounts, to meet the fair objections raised that poor people will not save up their money to pay the gas account, but would not mind paying so many pence per week. This is an objection I pay more attention to than any other; but I fear making a distinction between Mr. A., a respectable artizan, and Mr. B., a an ordinary laborer, who are neighbors, would create a great sentimental grievance. Mr. B. would say, "Why am I made to pay every week or month, as the case may be, while you trust Mr. A. for a whole quarter?" and one would be hard put to make a reasonable reply. But it really ought not to be forgotten that every one of us has at the present time a considerable number of such customers already. What is our experience? If I may judge from the reports of several gentlemen here who favor me with their published statements of account, their bad debts are very small indeed, and I venture to think they do not rise altogether, nor even mainly, from such customers as I plead for. Objections there are, and I do not shut my eyes to them, but the advantages of extending, and largely extending, our business in the direction indicated far outweighs, in my judgment, any objections that may be urged against it. If my professional brethren are daunted in their enterprise by such obstacles as I have named, or by others which I have not named, but which will probably be raised on the discussion upon this paper, then I confess I am utterly mistaken in them.

It is perfectly well known that nothing retards a reduction in the price of gas so much as a stagnant business, while with a progressive business the invariable accompaniment is a diminished price, and that again, in its turn, stimulates increased business, and so on. I believe, gentlemen, when the day comes—which I hope may not be in my time—that gas managers, from a love of ease and personal comfort, shelve these difficult questions instead of standing up and struggling with and overcoming them, they will be set aside to make room for a more enterprising body of men who will grapple with opposition and obstacle and subdue them. Do not for a moment suppose that I am capable of doing my brethren the injustice of laying this blame of lethargy at their door. From all my knowledge and experience of them they are blameless. We must, I fear, look further, and lay it down at the door of either a timid or over cautious directorate. I have learnt to look upon maximum dividends as not an unmixed good; it tends to enervation and a "rest-and-be-thankful" spirit, good enough in its way, but often contemptible in its operation.

Gentlemen, I hope I have not wearied you. I look for the day when every cottager shall be furnished with our staple article for lighting, heating and cooking, which will enormously increase our business, consolidate our interests, and make them rest upon the foundation of a satisfied public—an animal some of us are prone to think never had anything but a mythical existence, or else passed away long ages ago, and of which no trace has ever been discovered by the most eminent scientists. The extension indicated in this paper must tell also upon existing consumers, and so instead of complimenting ourselves that our business had not suffered from retrogression, or proudly pluming ourselves upon a 3 per cent. increase, we should, in the course of a few years, double, treble and even quadruple our business, for many a house would use much more gas for cooking and heating than for lighting purposes; and in the course of time who shall say but even in provincial towns, such as that I have the honor and pleasure of representing, gas shall be furnished at 2s. 6d. instead of 4s. 6d. per 1,000 cubic feet, maximum dividends upon all classes of capital paid, and the shareholders oftener having the opportunity, now eagerly sought, of putting out their surplus cash at good interest; and, as a natural concomitant, the manager receiving his share of the advantages derived by all other classes—a matter, by-the-by, too often lost sight of amid, or swallowed up in the satisfaction experienced in the declaration of good dividends, the production of which he has not been altogether blameless in effecting.

Discussion.

The President, in inviting discussion on the paper, said that gas was only used to a limited extent among the poorer classes in the south of England.

Mr. T. Hardick said that on a recent visit to the gas works and offices of the Manchester corporation, he was surprised to find that they had some thousands of small accounts on their books, some of which were collected weekly, others monthly; and yet the amount written off as "bad debts" was very small. Being a corporation, they could do as they pleased in the matter of payment, and it was the invariable rule to demand a substantial deposit, according to a fixed scale, or an approved guarantee. Accounts unpaid were handed over to a distinct class of collectors, whose sole duty it was to look after the arrears. Prompt payment was demanded, and the supply cut off, at a week's notice, if the account was not paid. This was one way of meeting with a difficulty often met with even when deposits in advance were the rule. Consumers would, if allowed, sometimes get in arrear for a larger amount than they deposited in advance. The Manchester corporation also charged a fee of 1s. for connecting or removing a meter, and the gas appeared to be very generally used. Another difficulty was that of frequent changes of tenants. He had often been obliged to go and prevent meters being disposed of by auction, and this was a serious objection to any scheme for letting out fittings on hire. A guarantee might be taken from the owners of the property to maintain the fittings entire; but there would be a difficulty in obtaining it. The Association were, he thought, much indebted to Mr. Stone for his scheme of extension, as it was a question which had more or less occupied all present.

Mr. W. U. Tinney said he found a difficulty in obtaining payments in advance. In Scotland most of the fittings belonged to the landlords, who included a charge for them in the house rent.

Mr. Hardick remarked that he had endeavored to get a guarantee from owners of property for the fittings in the event of his company providing them, but without success.

Mr. G. Garnett said that his experience in this matter was much the same as that of Mr. Hardick. He provided a form of guarantee to be filled up on behalf of every intending consumer, and failing this he insisted upon a deposit. His rule was a guarantee, or a deposit, and he did not object to allow 5 per cent. on pre payments. As soon as a tenant vacated a house, he (Mr. Garnett) sent for the meter. If firmness in carrying out this rule was exercised, the consumer soon came round to it. He was pleased to hear what Mr. Stone had said, and the President had remarked that the working classes in the south of England rarely used gas. This was because they did not possess so much intelligence, or practice so much thrift, as the poorer classes in Scotland and the north of England. In the large towns of Scotland, the "flats" inhabited by laboring people were all well lighted by means of gas; and in Manchester the workpeople's homes were to be found with plenty of gas, warm baths and other conveniences. Those people had been educated up to it. Mr. Stone's scheme would educate the working classes in this part of the country, and beyond doubt there was a very wide opening for it.

Mr. H. Sainsbury said that in his experience much depended upon the kind of working classes dealt with. He had some streets of small consumers who paid better than tradesmen; while some people were continually changing, and gave a great deal of trouble.

Mr. Crowe thought that the cheapness of oil, also the low price of oil lamps as compared with the cost of gas fittings, had much to do with the limited use of gas by the poorer classes. He knew of instances where the tenants of respectable houses preferred to burn oil rather than incur the expense of gas fittings. It would be a very good plan to carry a service into every house before the building was completed.

Mr. M'Gregor remarked that this was always done in Scotland, and it was a general custom in that country for the gas companies to demand a deposit, if they thought such a course advisable.

Mr. T. W. R. White thought that the great difficulty was the fittings difficulty. Oil lamps could, he said, be obtained for 1s. or 2s. each, while the gas fittings, even for a very small house, would run to 30s. or £2. Many people preferred doing without gas to incurring the expense of fittings. He once canvassed a district where scarcely any gas was used, and found several cases where people would be glad to use gas, but did not feel inclined to go to the expense of fittings. He proposed to his directors a scheme for letting fittings on hire, but they would not agree to it.

Mr. Crowe said, with regard to bad debts, the poorer classes in his district generally paid their accounts promptly, and he had no difficulty in getting the money. His losses were oftener among those who had the means and ought to have paid. A short time previously he laid on gas to a village inhabited by poor people, and his directors were opposed to this being done, on the ground that the bad debts would be large; but he had not yet lost anything in the district. Mr. Stone's paper would be very useful, for though it was almost impossible to carry out in full the scheme he proposed, there were many very good hints. The remark that gas companies supplied gas only when it was asked for was, he thought, very pertinent.

The President said that the expense of pipes and fittings appeared to be the principal obstacle to the extended use of gas among the poorer classes. His own rule was not to lay a main in a new district until pipes were put into the houses, and he generally took a deposit, because there were so many changes of tenancy in his district. A reduction in the price of gas tended to induce an increased consumption.

Mr. H. Cockey remarked that the Bristol United Gaslight Company usually demanded a deposit.

Mr. N. H. Humphreys (Westbury) read the following paper:

A FEW REMARKS ON LIME FOR PURIFYING GAS.

Our attention has lately been drawn to the subject of lime as used for purifying gas. Mr. William Foster spoke on the chemistry of spent lime, at the recent meeting of the British Association of Gas Managers; and within the last few weeks Mr. A. F. Wilson has given an account of Hislop's process for revivifying lime, at the meeting of the Southern District Association of Gas Engineers and Managers. I have therefore thought that a few remarks on the subject of lime would be of interest.

Commencing with the mineral substances from which lime is obtained, in passing we may notice that above 600 varieties of limestone are known, and they vary greatly in physical properties. There is the beautiful Bolsover magnesian limestone, of which the walls of our present Houses of Parliament are built; and there is the marly mud used for building walls, and sometimes cottages, by the peasants of Salisbury Plain. The term limestone is applied to any mineral containing more than about 50 per cent. of lime, which, almost without exception, exists in the form of carbonate of lime. If we submit carbonate of lime to a bright red heat, the carbonic acid and lime part company, the carbonic acid passing away in the form of gas. When a limestone is submitted to a red heat in a kiln, the carbonic acid is driven off, and the pure lime, together with the earthy impurities, which are but little affected by the heat, remains behind. The lime burners speak of "poor" or "rich" limestone, according to the percentage of lime contained in it. A poor limestone contains 60 or 70 per cent.; a rich limestone 80, 90, or more, per cent. of carbonate of lime. Carbonate of lime contains 44 per cent. of carbonic acid, so when a limestone containing 75 parts of carbonate is submitted to the action of the kiln, 33 parts of carbonic acid go off as gas, leaving behind 42 parts of lime and the 25 parts of earthy impurities. Hence the limestone loses weight in the kiln, and 100 parts of limestone yield from 60 to 75 parts of lime.

The lime is heated, or, to use the common term, "burnt," until it "slakes" readily, when water is thrown upon it, so as to be suitable for builders purposes. The time occupied in slaking, and the increase which takes place in its bulk during the operation, afford some indication of its quality. If more than 80 per cent. or so of pure lime be present, it slakes rapidly, and increases to more than double its original bulk. It is easy to test how much water a sample of commercial lime will take up in the operation of slaking, and we can thus obtain an indication of the amount of pure lime therein contained. The first thing is to ascertain whether the sample is completely burnt—that is to say, whether the whole of the carbonic acid has been driven off. In the case of a poor limestone, this must be done before the lime is considered to be fit for use by the builders; but a rich lime, while sufficiently burnt to satisfy the requirements of these constructive artists, may contain as much as 5, 7 or even 10 per cent. of carbonate of lime. This matter is important to us, since carbonate of lime is utterly inert as a purifying material, and I dare say that where lime is burnt specially for the use of large gas works, this point has received attention; but it happens that the larger portion of the lime purchased for gas purifying is prepared in the ordinary way, as for building purposes. There are two ways in which we can satisfy ourselves whether the lime is thoroughly burnt. One is by raising a sample, fresh from the kiln, to a strong red heat for an hour or two, and observing if any loss of weight takes place; the other is to stir a few grains in a little water, and add a few drops of strong acid, when any carbonic acid contained in the sample will be displaced, and produce effervescence. If there is a strong evolution of carbonic acid, it will be worth while to arrange with the lime burner that the line for purifying shall have a little longer sojourn in the kiln.

I have brought with me a sample of lime which bears a very good character both for building and gas purifying purposes, which I will proceed to test with acid. [Mr. Humphreys tested a sample, and it gave a slight effervescence.] Another sample containing 5 per cent. of carbonate effervesced strongly. I next proceed to show that lime should be delivered at the works as soon as possible after it is drawn from the kiln, and used in the purifiers as soon as possible after it is delivered at the works. If lime is exposed to a moist atmosphere for any considerable length of time, it increases in weight by absorbing moisture and carbonic acid. A few minutes since I poured some solution of lime into this beaker, and you see it has already become cloudy, in consequence of absorbing carbonic acid from the air; if left for a few days the whole of the lime contained in the solution would be changed into carbonate. This illustrates the process that takes place, though in a much less degree, when dry lime is exposed to moisture and air. The moisture does no positive harm, but it makes weight, and it is not worth while to buy moisture at the price of lime; but carbonic acid kills the lime as far as purifying is concerned; every pound of carbonic acid renders inert about 1¼ lbs. of lime.

Having tested the lime for carbonic acid, it can be tested with water, to see how much it will take up in slaking. From the portion which has been heated take a convenient quantity, say 50 grains, add about an equal weight of distilled water; after allowing it to stand for some time, dry it in a sand bath, or otherwise, and submit it to a temperature of 300° or so for an hour or two, then weigh; 50 grains of pure lime will take up and chemically combine with 16·075 grains of water, and with these data, and the increase of weight in a given quantity, the percentage of pure lime can be calculated. I place on the table for your inspection a little apparatus used by myself for the purpose of drying lime, or any other material. [Apparatus explained.]

A good sample of lime should (1) not lose weight when raised to a red heat, or effervesce strongly with acids; (2) it should absorb a reasonable quantity of water in the act of slaking; it should slake briskly, and increase considerably in bulk while so doing.

Now let us just for a moment, before proceeding further, glance at the substances which for our present purpose may be termed the impurities of lime. The most common of these are earthy, sandy, ferruginous or magnesian matters. Argillaceous substances are objectionable, as a limestone containing them is liable to be overburnt; the heat causes some of the constituents of the clay to enter into chemical combination with the lime, thus reducing the percentage of free lime in the product, just as carbonic acid absorbed from the atmosphere would do. And lime containing such matters

is also liable to set in the purifiers, increasing the back pressure toward the end of its service, rendering the use of pickaxes necessary for its removal therefrom. The presence of magnesia increases the liability to overburning. A moderate proportion of quartzose sand has no detrimental effect; the same may be said of iron ore.

Two new processes in connection with the use of lime for purifying have lately been brought forward. Mr. Foster has shown us that Mr. Harris can make lime to do two services in the purifier, instead of only one, as usually obtained. Mr. Hislop proposes to go farther still, and restore the lime to its original condition any number of times, thus making it "beautiful for ever" to the gas manager's eyes. Mr. Foster, while remarking on the chemistry of spent lime, on the occasion referred to above, brought out one very interesting and important fact. I refer to the presence of free sulphur in the used lime, which warrants us in concluding that lime, to a small extent, undergoes an analogous oxidizing process to that we obtain with oxide of iron. I need not remind you that lime is similar in one respect to oxide—they are both compounds of a metal and oxygen. Oxide consists of iron and oxygen; lime, of calcium and oxygen. Calcium and oxygen are such close friends that it is very difficult to separate them. The process of obtaining the pure calcium is so complicated, that although lime is so common, calcium is very rare, and 20 to 30 times more expensive than gold. I place on the table a small fragment of this interesting metal; if exposed to the atmosphere it would instantly become lime.

I have observed that if the hand be held over the stream of gas issuing from the opened test cock, the purifier being just put into use, it feels cool; as the contents of the purifier gradually become charged with impurities, the stream of gas feels warmer, and when it feels decidedly warm to the hand the purifier requires to be turned off, as the gas will stain the test paper. This shows that the lime in the purifier gradually increases in temperature, and I think an important item in Mr. Harris's process is the cooling of the lime. I am at present giving this subject further attention.

The process patented by Mr. Hislop consists of restoring the lime, in a chemical sense, to its original condition as limestone, by displacing any sulphur compounds in it by a current of carbonic acid gas contained in the furnace gases. The whole of the lime is thus converted into the form of carbonate, the same as it existed in the original limestone. It is then reburnt, or raised to a bright red neat, just as in the kiln, and quick lime is obtained. The value of this process at any particular works is very easily ascertained. From the cost of the quicklime deduct the amount received for spent lime, and the net cost per ton is thus obtained. In my own case, at Westbury, this is about 10s. per ton. We are told that Mr. Hislop's process will restore lime for about 6s. 3d. per ton complete. But the lime must be burnt as soon as possible after leaving the purifier; for if spent lime be exposed to the atmosphere for any length of time, the sulphur becomes fixed, so that it is not displaced by carbonic acid or by a red heat. It appears to me, therefore, that this process can only be adopted where the quantity of lime in use for purifying is sufficiently large to keep the appatus constantly in use.

The subject of avoiding nuisance in the process of removing spent lime is interesting; but I have already occupied a considerable portion of your time.

Discussion.

Mr. G. Garnett said it was all very well to be reminded of first principles —about carbonic acid, and so forth. He found the great difficulty in regard to lime was to induce people to use it wet enough and thick enough. There was no practical difficulty in using the lime in layers of 12 or even 18 inches thick. The old plan was to moisten the lime only sufficiently to make it cohere when squeezed in the hand, and to use it in thin layers. He found that by making the lime much wetter, and using it in thick layers, it would do 20 to 30 per cent. more work. The thicker layers did not increase the back pressure; at present he was using 3½ feet thickness of lime in two layers, and the difference of pressure between the inlet and outlet of the purifiers was 9-10ths. When he worked with four layers in each purifier there was a greater pressure, and he did not get so much work out of the lime. He supposed that when the lime was made moister than was the usual rule it assumed a more porous condition, and a more intimate molecular contact took place between the lime and the gas. The point he advocated was, thicker layers and the lime as moist as possible, so long as it did not become pasty.

He had allowed a purifier charged with thick layers of lime to become sulphuretted, and then made it first on the series to remove sulphur, and up to the last it did not give undue pressure. He had also lifted the lid of a purifier and sprinkled the lime with water by means of a watering pot, and the lime was improved, and seemed to receive new energy. When set to work again it removed a larger proportion of sulphur or carbonic acid than before being watered. He proved this with Mr. Harcourt's color test. He might also remark that on one occasion, being troubled with naphthaline, he raised the lid of a 12-feet purifier, and sprinkled the upper layer with benzoline, and this proved an effectual remedy.

Mr. Stone said at one time he used to prepare the lime for purifying in the ordinary way, but had recently used it much wetter. He thoroughly mixed it until it was as nearly as possible like mortar, yet not mortar. He thus obtained better results, and the back pressure at the inlet of the purifiers, which, of course, included that of the meter and holder, was only 4·5 inches.

Mr. Crowe.—Does not the additional moisture with the lime tend to harden it, and increase the back pressure?

Mr. Stone.—I have not found it do so.

Mr. T. W. R. White thought that the increased thickness of the layers would increase the back pressure, especially if, as was often the case, any tarry matter happened to get into the purifiers.

The President said he used two layers of lime, each 4 inches thick, and two layers of oxide in each purifier, and he had four purifiers in action. He had found from experience that new and old oxide, if mixed together, produced a reaction which resulted in the evolution or giving off of some of the sulphur contained in the old oxide. He therefore placed the newest oxide on the bottom layer of the purifier, and the old oxide on the top layer, the two layers of lime being between.

Mr. Humphrys remarked that the experience of Mr. Garnett when he watered the lime seemed to support the opinions that the cooling of the lime was an important point in Mr. Harris's process.

Mr. Garnett said everybody knew that the cooler the purifying material was the better it acted.

Chimney Sweeps vs. Gas Cooking.

The following amusing petition is circulating in Leicester, where the action of the Gas Committee, in letting out on hire, at low rates, gas cooking stoves, is causing no small amount of feeling:

The humble petition of the chimney sweepers of Leicester to the Committee of the Gas Department of the Town Council:—

Showeth, that your petitioners have hitherto paid all dues and demands made upon them for taxes, poor rates, borough and district rates, etc., without grumbling.

That your petitioners have always observed all alterations in the laws relating to their profession, both parliamentary and municipal, and particularly to the law abolishing climbing boys, and are now in consequence only employing full-grown men, carrying expanding brushes with many joints for the purposes of the trade.

That your petitioners observe with regret the introduction by your honorable committee of gas cooking utensils, which produce no soot, and which if persevered in will annihilate their trade.

That several instances have already occurred where, upon application to cleanse kitchen chimneys, we are met with the answer, "We now cook by gas, and don't use the kitchen chimney at all." Consequently, our summer trade is good for nothing.

That if this system is persevered in we shall have no soot to sell to the farmers, and the worms and slugs and grubs will devour the young plants, and damage the farmers and the community in general by the loss of the crops.

That your petitioners, being about 30 in number, resident in the borough, hereby make claim for compensation for loss of trade, either by annuities payable quarterly, or that your honorable committee would abolish at once the experiment of cooking by gas, or devise some means of relief for the serious damage to our profession. Then shall we be able once more to sing on Mayday the old song, the chorus of which is—

"Odzooks," says I, "get out of my way,"
For I'm off with my sweep—Soot oh!"

And your petitioners will ever pray, etc.—*Review of Gas and Water Engineering.*

Mortars, Ancient and Modern.

In hardness and binding qualities, the ancient mortars surpass the modern; but the supposition sometimes made that this superiority is due to certain secrets of manufacture or manipulation, which are now lost, is entirely groundless. The true explanation is, undoubtedly, that all mortars improve with age, and attain their maximum hardness and strength only after a very long time. This is accounted for by the fact that a chemical union takes place between the lime and silica of the sand composing the mass, and this is a process requiring many years to complete. Comparative examinations have shown that the ancient mortars contain more silicate of lime than the modern, and are consequently better in quality.—*Brick, Pottery and Glass Journal.*

DRAINAGE MAP

OF THE

CITY OF NEWPORT

AND PART OF MIDDLETOWN, R.I.

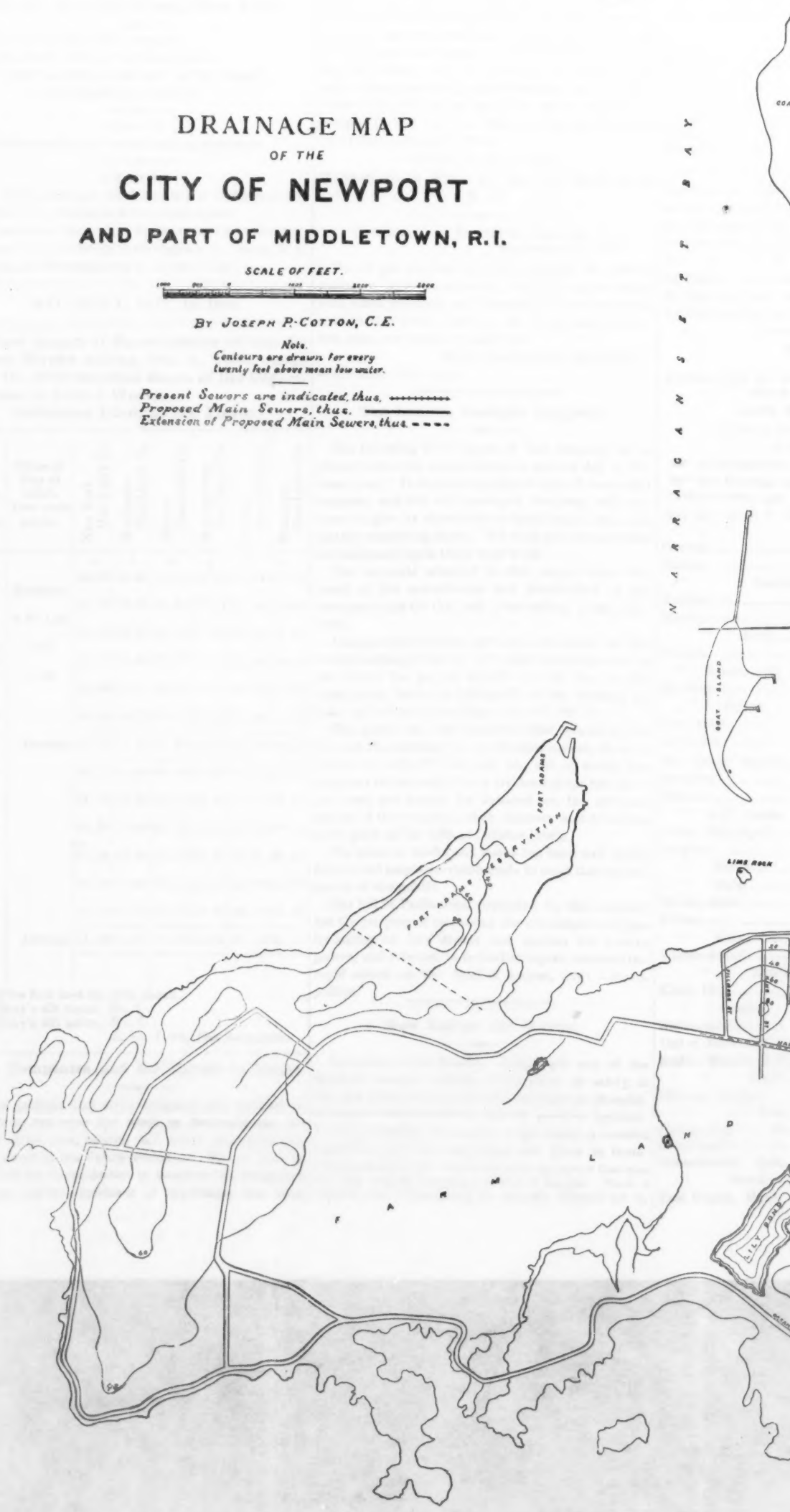
SCALE OF FEET.

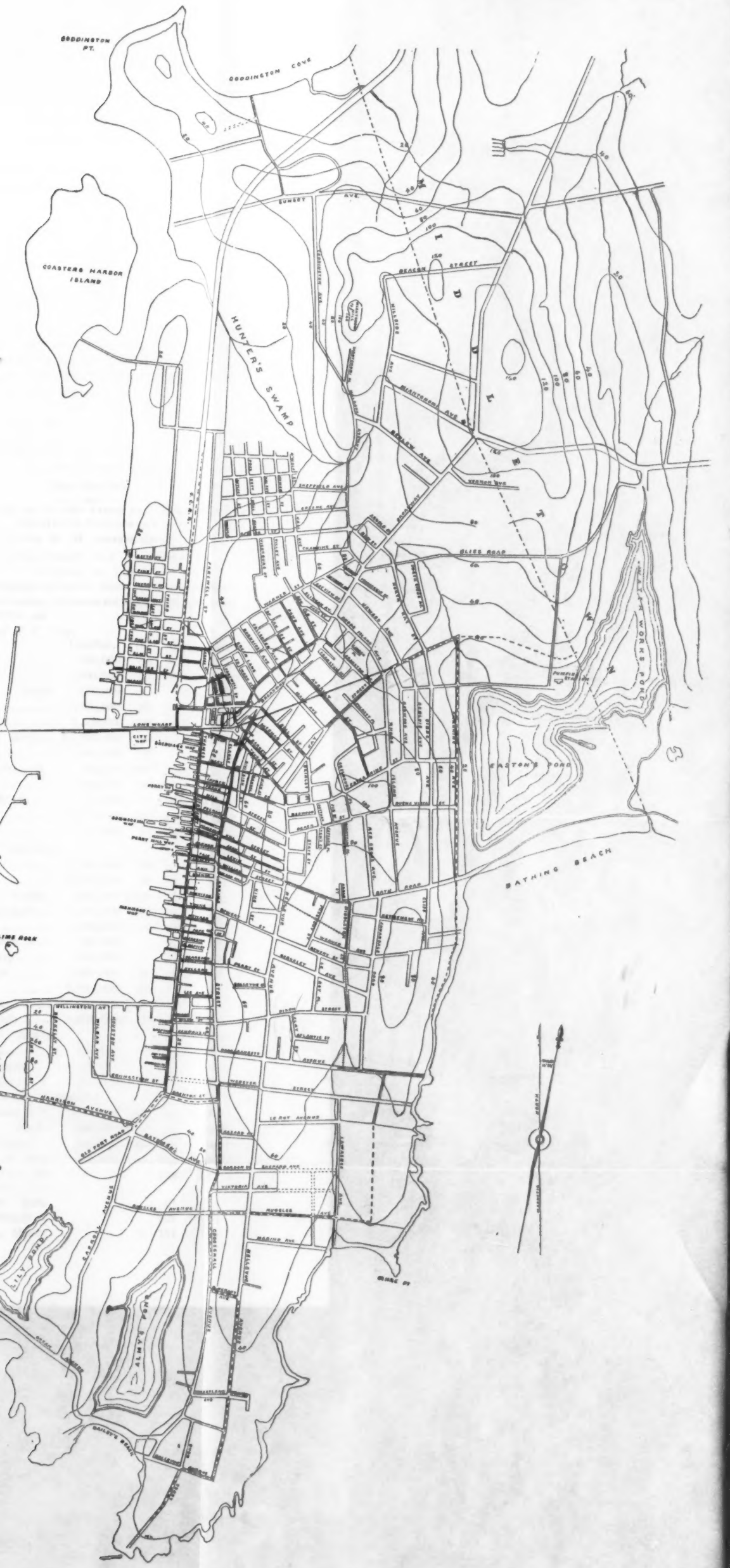
1000 500 0 1000 2000 3000

By JOSEPH P. COTTON, C. E.

Note.
Contours are drawn for every twenty feet above mean low water.

Present Sewers are indicated, thus. ••••••••••
Proposed Main Sewers, thus. ——————
Extension of Proposed Main Sewers, thus. - - - -

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SATURDAY, OCT. 16, 1880.

Official Report of Examinations of Gas for two Weeks ending Oct. 9, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1880. Sept.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gar-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
27		22.81	19.36	27.51	22.36	18.04	28.65
	Between						
28		22.92	19.29	26.83	22.17	18.54	29.08
	9.30 A.M.						
29		23.12	18.99	27.27	21.90	18.92	29.00
Oct.	and						
30		25.19	19.47	27.83	22.71	18.24	30.03
	1 P. M.						
1		24.34	19.15	27.66	22.19	18.33	29.80
2		24.06	18.52	27.11	22.07	18.64	28.57
	Average	23.74	19.13	27.37	22.23	18.45	29.23
4		25.87	18.36	27.93	22.38	18.61	29.26
5		24.88	18.44	27.67	22.52	18.77	29.11
6		24.84	18.58	27.33	22.22	18.53	29.05
7		24.02	18.82	27.38	22.56	18.62	29.92
8		26.58	19.40	27.44	22.56	19.02	29.76
9		24.54	19.25	27.64	23.04	18.94	29.53
	Average	24.62	18.81	27.56	22.52	18.74	29.27

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Gas Companies and the Repair of Roads.

The gaslight and coke company are anxious to break up and relay the roads in Bethnal-green, instead of, as now, leaving the latter process to be performed by the Vestry workmen. We are glad to see that the board decline to accede to the company's request, for we consider it of importance that local boards should retain the power to execute the repairs and charge the companies the expense. In the past complaints were constant in all parts of the metropolis at the manner in which roads and pavements had been left by the excavators of the gas and water companies. It is sufficiently vexatious to see good work spoilt; it would be worse were the local boards to give away the power of making the companies pay for the best possible repair.

Compressed Air as a Motor.

The question of the economy of the use of compressed air as a motor is about to be tried on an extensive scale at Rochester, N. Y. A large company has been formed in that city, which has purchased an extensive water power to be utilized in compressing air, which will be conveyed in pipes to the various manufacturing establishments and machine shops of the city, to be used as a motor in place of steam. It will also be used for the propulsion of street cars.—*Scientific Press.*

Reduction in Price of Gas in Rochester, N. Y.

OFFICE OF THE ROCHESTER GASLIGHT CO.,
September 30, 1880.

For all gas supplied by this company to private consumers after December 31, 1880, the regular price, nett, when promptly paid, according to the usual rule, until further notice, will be one dollar and twenty-five cents per thousand cubic feet.

MATT. CARTWRIGHT, Secretary.

—*Rochester Democrat.*

The London Gaslight Company.

The following is the report of this company to be placed before the shareholders on the 6th day of October next. It shows a continued state of successful business, and this well managed company will continue to give its shareholders satisfaction, and, ultimately, something more. We shall give the accounts and comment upon them next week.

The accounts annexed to this report show the result of the manufacture and distribution of the company's gas for the half year ending June, 30th, 1880.

A comparison of these accounts with those for the corresponding period of 1879 exhibits an increase in the rental for gas of £3,829 15s. 6d.; but, on the other hand, there is a falling off in the receipts for coke and breeze amounting to £4,063 19s. 5d.

The profit and loss account, after providing for interest and dividend on preference capital, shows a balance of £20,517 11s. and 5d., out of which the directors recommend that a dividend at the rate of 10 per cent. per annum be declared on the ordinary capital of the company, such interest and dividends to be paid on the 15th of October, 1880.

The plant in works and mains has been well maintained, and ample provision made to meet the requirements of the public.

The bill in Parliament, promoted by the company for the purpose of increasing the consumption of gas by letting on hire stoves and engines for motive power, and referred to in the last report, received the royal assent on the 22nd of August, 1880.—*Metropolitan.*

New Lamps for Miners.

According to the London *Telegraph* one of the greatest boons to miners, on the score of safety, is the new miner's lamp, in which the light of phosphorescence is substituted for that of positive ignition. In this apparatus the interior of the screen is covered with a brightly luminous paint, and there is, therefore, nothing in its construction or character that can by any means become a source of danger. Such a contrivance, if answering the capacity claimed for it, must be of peculiar value, pecuniarily considered, in preventing the destruction of property by explosion. But the great advantage of such a lamp over those now in common use is its insuring against a peril from which the Davy lamp cannot protect the workmen. If that lamp be carried against a current of air mixed with fire damp, the explosive gas penetrates through the gauze and comes in actual contact with the flame, a catastrophe being the natural result of such contact; obviously, however, no risk of this sort could be involved in the use of a phosphorescent light by miners.—*Engineering News.*

Prices of Gas Coal.

The following are the prices at which the companies mentioned are shipping coal:

	New York.	Baltimore.	S. Amboy
Penn.....	$5.25	$4.10	$4.80
Scott's Youghiogheny..	5.00	3.75	
Montauk.....	5.00	3.70	
Newburgh Orrel.....	5.00	3.75	
Tyrconnell	5.00	3.75	
Despard.....	5.00	3.75	
West Fairmount.....	5.00	3.75	

To give some idea of the relative prices at the East and the West we give the following quotations of coal furnished by the Fort Pitt Coal Company:

At Pitsburgh, f.o.b. cars....	$1.30	per ton of	2000 lbs.
At Cleveland, f.o.b. cars....	2.90	"	"
At " f.o.b. vessels	3.05	"	"
At Buffalo, f.o.b. cars..	3.55	"	"
At Chicago, f.o.b. cars	3.60	"	"
At Indianapolis, f.o.b. cars.	3.00	"	"

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
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OCTOBER 16, 1880.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked*
Gas Co.'s of N. Y. City.				
Central.....	466,000	50	60	70
Harlem.....	1,800,000	50	70	75
" Bonds	170,000			103
Manhattan.....	4,000,000	50	178	183
Metropolitan.....	2,500,000	100	130	137
" Scrip...	$1,000,000	...	106	104
Mutual.....	5,000,000	100	70	75
" Bonds, go'd.	900,000	1000	100	104
Municipal.....	1,500,000	100	170	180
" Bonds	750,000		106	110
New York.....	4,000,000	100	104	106
Northern.....	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	112
Citizens.....	1,200,000	20	60	65
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal.....	1,500,000	100	70	80
Peoples.....	1,000,000	10	35	38
" Bonds.....	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan.....	1,000,000	100	60	63
Nassau.....	1,000,000	25	40	50
" Ctfs.....	700,000	1000	85	95
Williamsburgh	1,000,000	50	65	70
" Bonds		...	98	103
Kings Co.....	135,000	100	60	70
" Bonds.....	40,000	—	—	—
Richmond Co., S. I.	300,000	...	75	80
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	75	80
" Bonds	200,000	1000	95	100
Citizens, Newark.....	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Consolidated, Balt.			84	85
" Bonds....			159	110
East Boston, Mass...		25	114	120

Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	140	144
Hempstead, L. I....	25,000	100	...	—
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150.000	40	117½	
Jersey City	750,000	20	150	160
Jamaica, L. I.....	25,000	100	...	—
Jacksonville, Ill.....	120,000	50	100	...
Lewistown Maine...	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	110	112
Montreal, Canada....	2,000,000	100	148	149
New Haven, Conn...		25	140	150
Oakland, Cal.....			35	36
Peoples, Jersey City		...	85	90
" " Bds.				5
Pittsfield, Mass.....			120	130
Rochester, N. Y.....		50	70	80
" Citizens		100	30	35
Rondout & Kingston			75	80
St. Louis Missouri..	600 000	50	250	254
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
San Francisco Gas-Co., S. Fr'isco Cal.			77	79
Toledo, Ohio..... . .			95	97
Troy, Citizens.....	600,000	100	—	—
Washington, D. C...	1,500,000	20	200	215
" Scrip	500,000	20	125	—
Woonsocket, R. I....	150,000	100	80	...
Wilmington, Del....		50	174	...
Yonkers.....		50	—	70

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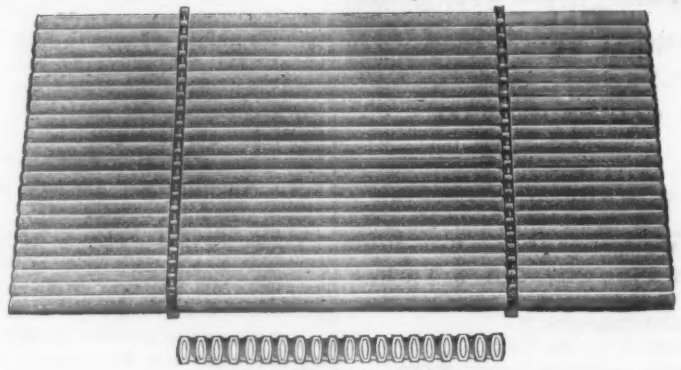

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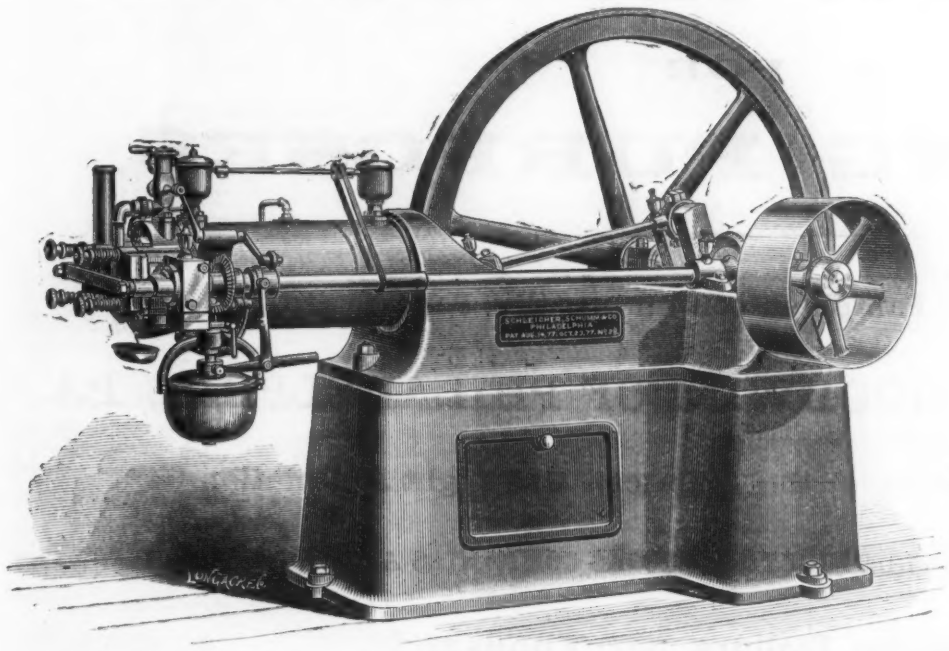

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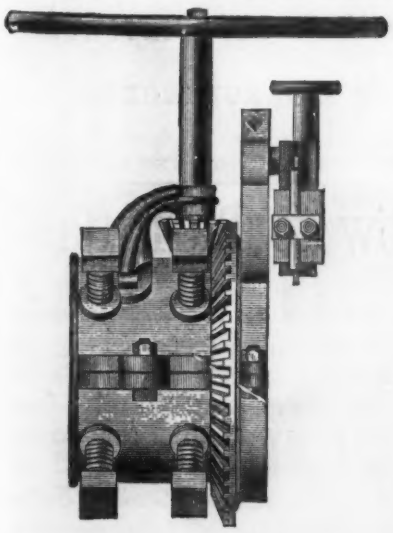

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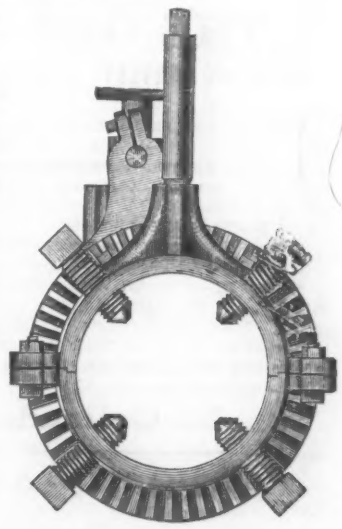

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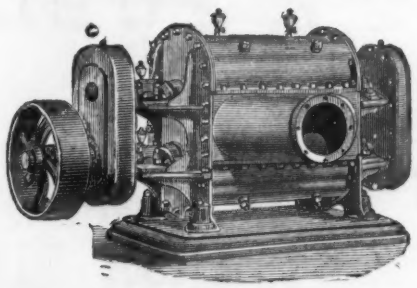

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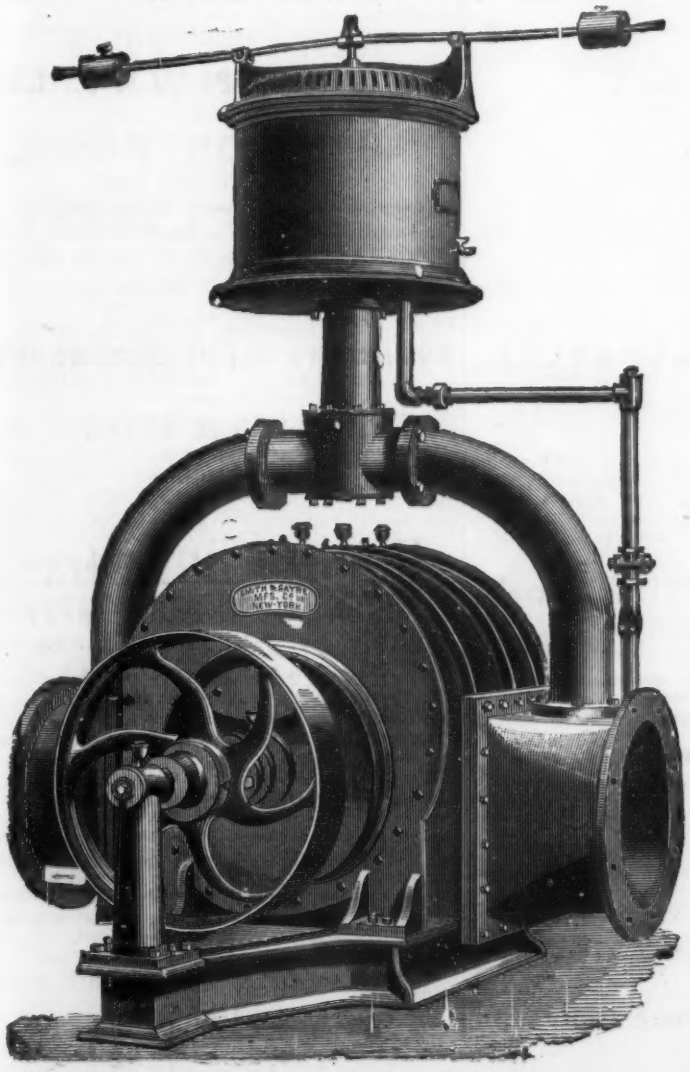

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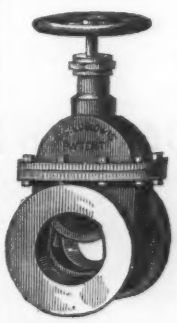

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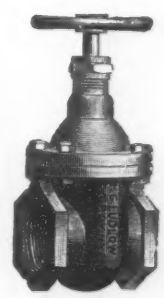

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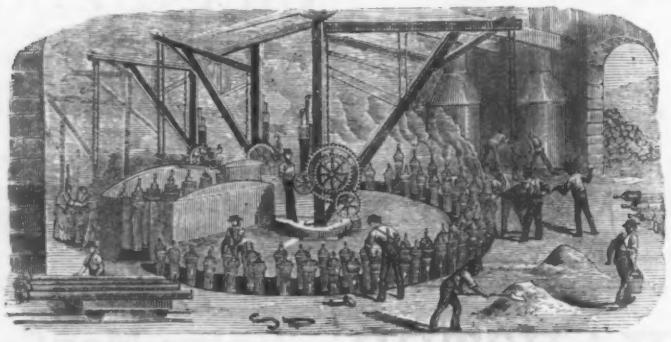

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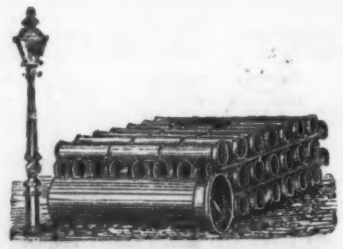

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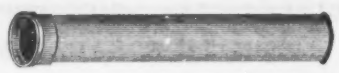

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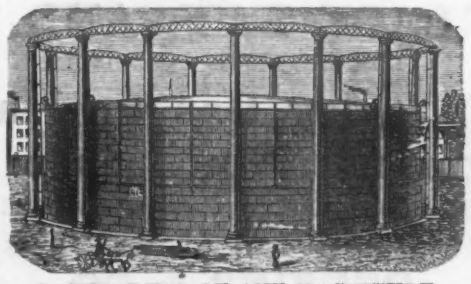

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351-1y

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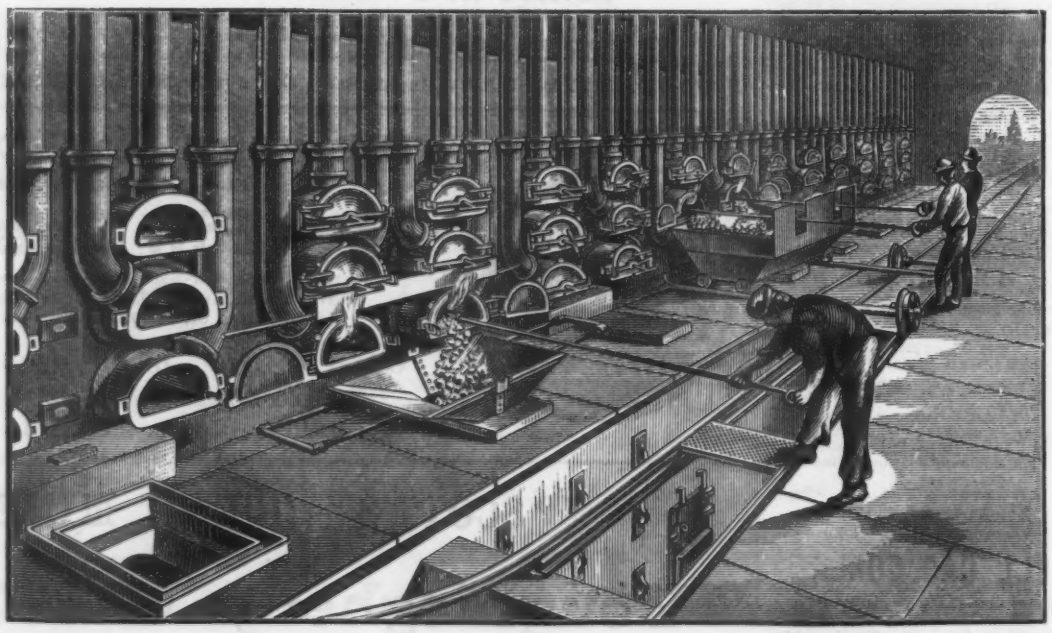

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